# THE BELL SYSTEM

# TECHNICAL JOURNAL

A JOURNAL DEVOTED TO THE SCIENTIFIC AND ENGINEERING ASPECTS OF ELECTRICAL COMMUNICATION

TABLES OF CONTENTS

AND

CUMULATIVE INDEX

VOLUMES XI-XX 1932-1941

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
NEW YORK

# THE BELL SYSTEM TECHNICAL JOURNAL

Published quarterly by the American Telephone and Telegraph Company 195 Broadway, New York, N. Y. The Ca The Op fier The Tir

Constar Some P

Regene Contem Co

A New

Cellulo Cellulo

The D

Precisi Ca Cathoo

A Voic

# THE BELL SYSTEM TECHNICAL JOURNAL

# TABLES OF CONTENTS

Volumes XI-XX

(1932-1941)

Volume XI, 1932

# JANUARY, 1932

The Cathode Ray Oscillograph—J. B. Johnson	1
The Operation of Vacuum Tubes as Class B and Class C Ampli-	
fiers-C. E. Fay	28
The Time Factor in Telephone Transmission—O. B. Blackwell	53
Constant Frequency Oscillators-F. B. Llewellyn	67
Some Physical Properties of Wiping Solders—	
D. A. McLean, R. L. Peek, Jr., and E. E. Schumacher 10	01
Regeneration Theory—H. Nyquist 1.	26
Contemporary Advances in Physics, XXIII-Data and Nature of	
Cosmic Rays—Karl K. Darrow 1-	48
APRIL, 1932	
A New Key West-Havana Carrier Telephone Cable—	
H. A. Affel, W. S. Gorton and R. W. Chesnut 19	97
Cellulose Acetate Treatment for Textile Insulation-Engineering	
Development—E. B. Wood and D. R. Brobst 2	13
Cellulose Acetate Treatment for Textile Insulation—Development	
of the Manufacturing Process—C. R. Avery and H. Kress 2.	31
The Development of a Handset for Telephone Stations-	
W. C. Jones and A. H. Inglis 2-	45
Precision Methods Used in Constructing Electric Wave Filters for	
Carrier Systems—G. R. Harris	64
Cathode Sputtering—A Commercial Application—Hal F. Fruth 28	
A Voice and Ear for Telephone Measurements—	
A H Inglis C H C Gray and R T Loubins )	03

# JULY, 1932

Ultra-

Mutu

Some

Some

New

Car Mu

Cor

De

Lo

E

Henry as an Electrical Pioneer—Bancroft Gherardi 327 The Caesium-Oxygen-Silver Photoelectric Cell—
C. II. Prescott, Jr., and M. J. Kelly 334
Two-Way Radio Telephone Circuits—S. B. Wright and D. Mitchell 368
Magnet Steels and Permanent Magnets—Relationships Among
Their Magnetic Properties—K. L. Scott.
A Method of Measuring Acoustic Impedance—P. B. Flanders
Transmission Lines for Short-Wave Radio Systems—
E. J. Sterba and C. B. Feldman 411
An Efficient Miniature Condenser Microphone System-
H. C. Harrison and P. B. Flanders 451
Wire Communication Aids to Air Transportation—II. II. Nance 462
OCTOBER, 1932
World-Wide Telephony—Its Problems and Future—
B. Gherardi and F. B. Jewett 485
Long Distance Telephone Circuits in Cable—
A. B. Clark and H. S. Osborne 520
The Conception and Demonstration of Electron Waves-
C. J. Davisson 540
An Expansion for Laplacian Integrals in Terms of Incomplete
Gamma Functions, and Some Applications—E. C. Molina 563
Contemporary Advances in Physics, XXIV—High Frequency
Phenomena in Gases, First Part—Karl K. Darrow
Transformer Coupling Circuits for High-Frequency Amplifiers—
A. J. Christopher 608
Volume XII, 1933
JANUARY, 1933
Pulp Insulation for Telephone Cables—
H. G. Walker and L. S. Ford
A Recording Transmission Measuring System for Telephone
Circuit Testing—F. H. Best
Probability Theory and Telephone Transmission Engineering—
Ray S. Hoyt 35
An Oscillograph for Ten Thousand Cycles—A. M. Curtis
Contemporary Advances in Physics, XXV-High-Frequency

Phenomena in Gases, Second Part-Karl K. Darrow. . . . . 91

W. R. Bennett 228

T. G. Castner and C. W. Carter, Jr. 347

# APRIL, 1933

V 334

368

383

4112

411

451

462

485

520

546

563

576

08

1

2

6

1

Phenomena—

C. R. Englund, A. B. Crawford and W. W. Mumford 197

New Results in the Calculation of Modulation Products—

# JULY, 1933

Carrier in Cable—A. B. Clark and B. W. Kendall. 251

Mutual Impedance of Grounded Wires Lying On or Above the Surface of the Earth—Ronald M. Foster. 264

Contemporary Advances in Physics, XXVI—The Nucleus, First Part—Karl K. Darrow. 288

A System of Effective Transmission Data for Rating Telephone Circuits—F. W. McKown and J. W. Emling. 331

Developments in the Application of Articulation Testing—

### OCTOBER, 1933

- Loudness, Its Definition, Measurement and Calculation—

  Harvey Fletcher and W. A. Munson 377

  Effect of Atmospheric Humidity and Temperature on the Relation

  between Moisture Content and Electrical Conductivity of Cot-
- John G. Ferguson 452
- Some Theoretical and Practical Aspects of Noise Induction— R. F. Davis and H. R. Huntley 469
- Audio Frequency Atmospherics— E. T. Burton and E. M. Boardman 498
- Certain Factors Limiting the Volume Efficiency of Repeatered Telephone Circuits—Leonard Gladstone Abraham. 517

# Volume XIII, 1934

JANUARY, 1934

An Ex

The I

Conte

The I

Rege

Wid A S

The Lin

> Ho Ex

Stabilized Feedback Amplifiers—H. S. Black	1
Open-Wire Crosstalk—A. G. Chapman	10
Vacuum Tube Electronics at Ultra-high Frequencies—	
F. B. Llewllyn	50
Contemporary Advances in Physics, XXVII—The Nucleus, Second Part—Karl K. Darrow	103
Tute Mari N. Durrott.	102
APRIL, 1934	
The Carbon Microphone: An Account of Some Researches Bearing on	
Its Action—F. S. Goucher	163
Open-Wire Crosstalk—A. G. Chapman	195
Symposium on Wire Transmission of Symphonic Music and Its Repro- duction in Auditory Perspective:	
Basic Requirements—Harvey Fletcher	230
Physical Factors—J. C. Steinberg and W. B. Snow.	245
Loud Speakers and Microphones—E. C. Wente and A. L. Thuras	
Amplifiers—E. O. Scriven	
Transmission Lines-H. A. Affel, R. W. Chesnut and R. H. Mills.	285
System Adaptation—E. H. Bedell and Iden Kerney	
JULY, 1934	
The Compandor-An Aid Against Static in Radio Telephony-	
R. C. Mathes and S. B. Wright	315
The Effect of Background Noise in Shared Channel Broadcasting-	
C. B. Aiken	3.3.3
Wide-Band Open-Wire Program System-H. S. Hamilton	351
Line Filter for Program System-A. W. Clement	382
Contemporary Advances in Physics, XXVIII-The Nucleus, Third	
Part-Karl K. Darrow	391
Electrical Wave Filters Employing Quartz Crystals as Elements-	
W. P. Mason	405
Some Improvements in Quartz Crystal Circuit Elements—	
F. R. Lack, G. W. Willard and I. E. Fair	453
A Theory of Scanning and Its Relation to the Characteristics of	
The Transmitted Signal in Telephotography and Television-	
Pierre Mertz and Frank Grav	

### OCTOBER, 1934

An Extension of the Theory of Three-Electrode Vacuum Tube Circuits—S. A. Levin and Liss C. Peterson. 523

The Electromagnetic Theory of Coaxial Transmission Lines and Cylindrical Shields—S. A. Schelkunoff. 532

Contemporary Advances in Physics, XXVIII—The Nucleus, Third Part—Karl K. Darrow. 580

The Measurement and Reduction of Microphonic Noise in Vacuum Tubes—D. B. Penick. 614

Fluctuation Noise in Vacuum Tubes—G. L. Pearson. 634

Systems for Wide-Band Transmission Over Coaxial Lines—

L. Espenschied and M. E. Strieby 654

Regeneration Theory and Experiment—

E. Peterson, J. G. Kreer and L. A. Ware 680

# Volume XIV, 1935

### JANUARY, 1935

# **APRIL**, 1935

Dr. Ge Dr. Ca Some To Circula

Opera Furth

Trans

Tech

Cable Crosstalk—Effect of Non-Uniform Current Distribution in the	
Wires-R. N. Hunter and R. P. Booth	170
Experiments with Directivity Steering for Fading Reduction-	
E. Bruce and A. C. Beck	105
A General Theory of Electric Wave Filters—H. W. Bode	211
Ideal Wave Filters-H. W. Bode and R. L. Dietzold	215
Ultra-Short-Wave Propagation: Mobile Urban Transmission Charac-	
teristics-C. R. Burrows, L. E. Hunt and A. Decino	253
An Application of Number Theory to the Splicing of Telephone	
Cables - H. P. Lawther, Jr.	273
Contemporary Advances in Physics, XXIX-The Nucleus, Fourth	
Part-Karl K. Darrow	285
Ferromagnetic Distortion of a Two-Frequency Wave-	
Robert M. Kalb and William R. Bennett	322
JULY, 1935	
Further Results of a Study of Ultra-Short-Wave Transmission	
Phenomena-C. R. Englund, A. B. Crawford and W. W. Mumford	369
Acoustical Instruments—E. C. Wente	
Thermionic Electron Emission—J. A. Becker	
Radio Propagation Over Spherical Earth—Chas. R. Burrows	
A Single-Sideband Short-Wave System for Transatlantic Telephony—	
F. A. Polkinghorn and N. F. Schlaack	489
Mutual Impedances of Parallel Wires—	
Ray S. Hoyt and Sallie Pero Mead	509
An Unattended Ultra-Short-Wave Radio Telephone System—	
N. F. Schlaack and F. A. Polkinghorn	534
Around the World by Telephone	

# OCTOBER, 1935

()

3 3 7

()

5 C A C 1 II E D 7	1
Dr. George A. Campbell—F. B. Jewett	
Dr. Campbell's Memoranda of 1907 and 1912.	558
Some Aspects of Low-Frequency Induction Between Power and	
Telephone Circuits-H. R. Huntley and E. J. O'Connell	573
Circulating Currents and Singing on Two-Wire Cable Circuits—	
L. G. Abraham	600
Operation of Ultra-High-Frequency Vacuum Tubes-F. B. Llewellyn	632
Further Extensions of Theory of Multi-Electrode Vacuum Tube	
Circuits-S. A. Levin and L. C. Peterson	666
Transatlantic Long-Wave Transmission-	
Austin Bailey and H. M. Thomson	680
Technical Digests—	
1. Superiorities of Lead-Calcium Alloys for Storage Battery	
Construction-H. E. Haring, U. B. Thomas, E. E. Schumacher	
and G. S. Phipps	699
2. Marine Radio Telephone Service for Boston Harbor-	
F. A. Gifford and R. B. Meader	702
3. Harbor Craft Ship-to-Shore Radio Telephone Service in P	
Sound Area—E. B. Hansen	708
4. Ship Sets for Harbor Ship-to-Shore Service—II. N. Willets	
5. An Electromechanical Representation of a Piezoelectric	
Crystal-W. P. Mason	

# Volume XV, 1936 JANUARY, 1936

Long-Wave Radio Transmission Phenomena Associated with a Cessa-
tion of the Sun's Rays-Austin Bailey and A. E. Harper
The Corrosion of Metals-I. Mechanism of Corrosion Processes
R. M. Burns 20
Magnetic Measurements at Low Flux Densities Using the Alternating
Current Bridge-Victor E. Legg
The Present Status of Ferromagnetic Theory—R. M. Bozorth
Some Equivalence Theorems of Electromagnetics and Their Application
to Radiation Problems—S. A. Schelkunoff
Magnetic Alloys of Iron, Nickel, and Cobalt—G. W. Elmen
Improvements in Communication Transformers—
A. G. Ganz and A. G. Laird 136
Technical Digests—
1. Measurement of Telephone Noise and Power Wave Shape-
J. M. Barstow, P. W. Blye and H. E. Kent 151
2. On the Correlation of Radio Transmission with Solar Phenom-
ena—A. M. Skellett 157
3. Eclipse Effects in the Ionosphere—
J. P. Schafer and W. M. Goodall 162
4. Earth Resistivity and Geological Structure-R. H. Card 167
APRIL, 1936
The Reliability of Short-Wave Radio Telephone Circuits-
R. K. Potter and A. C. Peterson, Jr. 181
Spontaneous Resistance Fluctuations in Carbon Microphones and
Other Granular Resistances—C. J. Christensen and G. L. Pearson 197
Contemporary Advances in Physics, XXX-The Theory of Mag-
netism—Karl K. Darrow 224
The Proportioning of Shielded Circuits for Minimum High-Frequency
Attenuation-E. I. Green, F. A. Leibe and H. E. Curtis 248
Hyper-Frequency Wave Guides-General Considerations and Experi-
mental Results—G. C. Southworth. 284
Hyper-Frequency Wave Guides-Mathematical Theory-
John R. Carson, Sallie P. Mead and S. A. Schelkunoff 310
A Magneto-Elastic Source of Noise in Steel Telephone Wires—
W. O. Pennell and H. P. Lawther 334
An Extension of Operational Calculus—John R. Carson 340
Technical Digest—
Determination of the Corrosion Behavior of Painted Iron and the
Inhibitive Action of Paints-R. M. Burns and H. E. Haring 343

# JULY, 1936

essa-

es 1

ting

30 --- 63 ion --- 92 --- 113

ird 130

ent 151 nenom-157

ill 162 - 167

r. 181

n 197 -224

248

284

310

334 340

343

<b>3</b> ,
A Laplacian Expansion for Hermitian-Laplace Functions of High
Order-E. C. Molina
The Relation Between Penetration and Decay in Creosoted Southern
Pine Poles-R. H. Colley and C. H. Amadon 363
Tandem Operation in the Bell System—F. M. Bronson 380
A Non-Directional Microphone R. N. Marshall and F. F. Romanow 405
Oscillations in Systems with Non-Linear Reactance—R. V. L. Hartley 424
Oscillations in an Electromechanical System-
L. W. Hussey and L. R. Wrathall 441
A New Type of Underground Telephone Wire—D. A. Quarles
Technical Digests—
Effect of Electric Shock on the Heart—
L. P. Ferris, B. G. King, P. W. Spence and H. B. Williams 455
A New High-Efficiency Power Amplifier for Modulated Waves-
W. H. Doherty 469
OCTOBER, 1936
Microchemical and Special Methods of Analysis in Communication
Research—Beverly L. Clarke and H. W. Hermance 483
Switchboards and Signaling Facilities of the Teletypewriter Exchange
System—A. D. Knowlton, G. A. Locke and F. J. Singer 504
A Transmission System for Teletypewriter Exchange Service—
R. E. Pierce and E. W. Bemis 529
A New Telephotograph System—F. W. Reynolds
Equivalent Networks of Negative Grid Vacuum Tubes at Ultra-High
Frequencies—F. B. Llewellyn
Forces of Oblique Winds on Telephone Wires—J. A. Carr 587
Corrosion of Metals—II. Lead and Lead-Alloy Cable Sheathing—
R. M. Burns 603
Technical Digest—
Reduction of Airplane Noise and Vibration—
C. J. Spain, D. P. Love and E. W. Templin 626

# Volume XVI, 1937

# JANUARY, 1937

A Million-Cycle Telephone System—M. E. Strieby.	1
A Power Amplifier for Ultra-High Frequencies—	
A. L. Samuel and N. E. Sowers	10
The Physical Reality of Zenneck's Surface Wave-W. Howard Wise.	35
Radio Propagation Over Plane Earth—Field Strength Curves—	
Charles R. Burrows	45
The Inductive Coordination of Common-Neutral Power Distribution	
Systems and Telephone Circuits-J. O'R. Coleman and R. F. Davis	76
Series for the Wave Function of a Radiating Dipole at the Earth's	
Surface—S. O. Rice.	101
Technical Digest—	
Currents and Potentials along Leaky Ground-Return Con-	
ductors—E. D. Sunde	110
APRIL, 1937	
Recent Trends in Toll Transmission in the United States-	
Edwin H. Colpitts	119
Crosstalk Between Coaxial Transmission Lines—	
S. A. Schelkunoff and T. M. Odarenko	144
Sound Recording on Magnetic Tape—C. N. Hickman	165
Constant Resistance Networks with Applications to Filter Groups-	
E. L. Norton	178
A Laboratory Evaluation of Wood Preservatives—	
R. E. Waterman, John Leutritz and Caleb M. Hill	194
Study of Magnetic Losses at Low Flux Densities in Permalloy Sheet-	
W. B. Ellwood and V. E. Legg	212
Moisture in Textiles—Albert C, Walker	228

# JULY, 1937

vers 10 e. . 35

vs 45

is 76

101

. 110

119

144 165

178

194

212 228

Scientific Research Applied to the Telephone Transmitter and Receiver—Edwin H. Colpitts	251
The Use of Coaxial and Balanced Transmission Lines in Filters and	
Wide-Band Transformers for High Radio Frequencies-	
W. P. Mason and R. A. Sykes	
A Ladder Network Theorem—John Riordan  Contemporary Advances in Physics, XXXI—Spinning Atoms and	
Spinning Electrons—Karl K. Darrow	319
A Multiple Unit Steerable Antenna for Short-Wave Reception-	
H. T. Friis and C. B. Feldman	337
OCTOBER, 1937	
Resistance Compensated Band-Pass Crystal Filters for Use in Un-	
balanced Circuits—W. P. Mason	423
Magnetic Generation of a Group of Harmonics—	
E. Peterson, J. M. Manley and L. R. Wrathall	
The Vodas—S. B. Wright	456
Radio Telephone Noise Reduction by Voice Control at Receiver-	
C. C. Taylor	475
Transmitted Frequency Range for Circuits in Broad-Band Systems-	
H. A. Affel	487
The Dielectric Properties of Insulating Materials—	
E. J. Murphy and S. O. Morgan	493
Variable Frequency Electric Circuit Theory with Application to the	
Theory of Frequency-Modulation—	
John R. Carson and Thornton C. Fry	513
Irregularities in Broad-Band Wire Transmission Circuits—	
Pierre Mertz and K. W. Pfleger	541
Technical Digests—	
Transoceanic Radio Telephone Development—Ralph Bown	560
A Negative Grid Triode Oscillator and Amplifier for Ultra-High	
Frequencies—A. L. Samuel	568
Addendum—	
Radio Propagation over Plane Earth—Field Strength Curves	
-C. R. Burrows	574

# Volume XVII, 1938

# JANUARY, 1938

Hert Insti Trar Spec

Hig An Ma

Sta

Ul

Ai D

> T T E

New Transmission Measuring Systems for Telephone Circuit Main-	
tenance—F. II. Best	1
The Impedance Concept and its Application to Problems of Reflection,	
Refraction, Shielding and Power Absorption—S. A. Schelkunoff.	17
On the Theory of Space Charge Between Parallel Plane Electrodes	
-C. E. Fay, A. L. Samuel and W. Shockley	49
A Carrier Telephone System for Toll Cables-	
C. W. Green and E. I. Green	80
Cable Carrier Telephone Terminals—	
R. W. Chesnut, L. M. Ilgenfritz and A. Kenner	106
Crystal Channel Filters for the Cable Carrier System—C. E. Lane	125
Crosstalk and Noise Features of Cable Carrier Telephone System-	
M. A. Weaver, R. S. Tucker and P. S. Darnell	137
A New Single Channel Carrier Telephone System—	
H. J. Fisher, M. L. Almquist and R. H. Mills	162
APRIL, 1938	
Studies of Telephone Line Wire Spacing Problems-	
J. A. Carr and F. V. Haskell	195
	229
An Explanation of the Common Battery Anti-sidetone Subscriber Se	et-
C. O. Gibbon	
The Occurrence and Effect of Lockout Occasioned by Two Echo Sup-	
pressors—Arthur W. Horton, Jr.	258
Characteristic Time Intervals in Telephonic Conversation—	
A. C. Norwine and O. J. Murphy	281
Radioactivity-Artificial and Natural-Karl K Darrow	202

# JULY, 1938

, s + 49

1—245

3 ,	
Hertz, the Discover of Electric Waves-Julian Blanchard	327
Instruments for the New Telephone Sets-W. C. Jones	338
Transmission Features of the New Telephone Sets-A. H. Inglis	358
Spectrochemical Analysis in Communication Research—	
Beverly L. Clarke and A. E. Ruehle	381
High Speed Motion Picture Photography—W. Herriott	393
An Optical Harmonic Analyzer—H. C. Montgomery	406
Magnetic Shielding of Transformers at Audio Frequencies-	
W. G. Gustafson	416
Coaxial Cable System for Television Transmission—M. E. Strieby	438
Stabilized Feedback Oscillators—G. H. Stevenson	458
The Discovery of Electron Waves—C. J. Davisson	475
OCTOBER, 1938	
Ultra-Short-Wave Transmission and Atmospheric Irregularities—	
C. R. Englund, A. B. Crawford and W. W. Mumford	489
Amplitude Range Control—S. B. Wright	
Devices for Controlling Amplitude Characteristics of Telephonic	
Signals—A. C. Norwine	539
The Exponential Transmission Line—Chas. R. Burrows	555
The Bridge Stabilized Oscillator—L. A. Meacham	
Effect of Space Charge and Transit Time on the Shot Noise in Diodes-	
A. J. Rack	592
Fundamentals of Teletypewriters Used in the Bell System-	
E. F. Watson	620
The Dielectric Properties of Insulating Materials—	
F I Murphy and S O Margan	640

# Volume XVIII, 1939

# JANUARY, 1939

The

Sur

Th

T

L

Electrostatic Electron-Optics—Frank Gray	1
Equivalent Modulator Circuits-E. Peterson and L. W. Hussey	32
An Improved Three-Channel Carrier Telephone System-	
J. T. O'Leary, E. C. Blessing and J. W. Beyer	40
Crossbar Dial Telephone Switching System—	
F. J. Scudder and J. N. Reynolds	76
A Twelve-Channel Carrier Telephone System for Open-Wire Lines	
-B. W. Kendall and H. A. Affel	110
Recent Developments in the Measurement of Telegraph Transmission	
-R. B. Shanck, F. A. Cowan and S. I. Corv	143
Contemporary Advances in Physics, XXXII. Particles of the Cosmic	
Rays—Karl K. Darrow	190
Hurricane and Flood-September 1938-W. II. Harrison	
A Terrain Clearance Indicator-Lloyd Espenschied and R. C. Newhouse	
Transcontinental Telephone Lines—J. J. Pilliod.	
APRIL, 1939	
Some Ceramic Manufacturing Developments of the Western Electric	
Company - A. G. Johnson and L. I. Shaw	255
The Production of Ultra-High-Frequency Oscillations by Means of	
Diodes F. B. Llewellyn and A. E. Bowen	280
A Representation of the Sunspot Cycle—C. N. Anderson	
The Number of Impedances of an n Terminal Network-John Riordan	
Copper Oxide Modulators in Carrier Telephone Systems—	
R. S. Caruthers	315
Some Applications of the Type "J" Carrier System-	
L. C. Starbird and J. D. Mathis	338
Line Problems in the Development of the Twelve-Channel Open-Wire	
Comion Sentence I M Hamfaita B V Hambar and A I Whiteman	26.2

### JULY, 1939

Frequency-Modulation: Theory of the Feedback Receiving Circuit

— John R. Carson 395

The Application of Negative Feedback to Frequency-Modulation
Systems—J. G. Chaffee 404

Survey of Magnetic Materials and Applications in the Telephone
System—V. E. Legg 438

Impedance Properties of Electron Streams—Liss C. Peterson 465

Plastic Materials in Telephone Use—J. R. Townsend and W. J. Clarke 482

The Dielectric Properties of Insulating Materials—

E. J. Murphy and S. O. Morgan 502

### OCTOBER, 1939

40

76

1 110

143

100

218

222

235

255

280 292

300

315

338

363

Experience in Applying Carrier Telephone Systems to Toll Cables

—W. B. Bedell, G. B. Ransom and W. A. Stevens 547

The Toronto-Barrie Toll Cable—M. J. Aykroyd and D. G. Geiger. 588

The Computation of the Composite Noise Resulting from Random
Variable Sources—E. Dietze and W. D. Goodale, Jr. 605

Load Rating Theory for Multi-Channel Amplifiers—

B. D. Holbrook and J. T. Dixon 624

The Quantum Physics of Solids, I—The Energies of Electrons in
Crystals—W. Shockley 645

Dial Clutch of the Spring Type—C. F. Wiebusch. 724

# Volume XIX, 1940

# JANUARY, 1940

- The Physical Basis of Ferromagnetism—R. M. Bozorth.

  Contact Phenomena in Telephone Switching Circuits—A. M. Curtis 40

  Effect of the Quadrature Component in Single Sideband Transmission—

  H. Nyquist and K. W. Pfleger 63

  Low Temperature Coefficient Quartz Crystals—W. P. Mason 74

  A New Standard Volume Indicator and Reference Level—
- H. A. Chinn, D. K. Gannett, and R. M. Morris 94 Metallic Materials in the Telephone System—

# Earle E. Schumacher and W. C. Ellis 138 Technical Digest—

An Interesting Application of Electron Diffraction—

L. H. Germer and K. H. Storks 152

# APRIL, 1940

Single

Telev

Insul Desi Pa

P

Stea Eng Tir Ste En

T

S

F

Advances in Carrier Telegraph Transmission—A. L. Matte	161			
	200			
Electrical Wave Filters Employing Crystals with Normal and Divided				
Electrodes-W. P. Mason and R. A. Sykes	221			
The Coronaviser, an Instrument for Observing the Solar Corona in Full				
Sunlight—A. M. Skellett	240			
Lead-Tin-Arsenic Wiping Solder—				
Earle E. Schumacher and G. S. Phipps	262			
Nuclear Fission—Karl K. Darrow	267			
A Solution for Faults at Two Locations in Three-Phase Power Systems				
—E. F. Vaage	500			
A Single Sideband Musa Receiving System for Commercial Operation				
on Transatlantic Radio Telephone Circuits—F. A. Polkinghorn.	306			
JULY, 1940				
Crosstalk in Coaxial Cables-Analysis Based on Short-Circuited and				
Open Tertiaries—K. E. Gould	341			
Crosstalk Between Coaxial Conductors in Cable—				
R. P. Booth and T. M. Odarenko	358			
Compressed Powdered Molybdenum Permalloy for High Quality				
Inductance Coils-V. E. Legg and F. J. Given				
High Accuracy Heterodyne Oscillators—T. Slonczewski	4()7			
Relations Between Attenuation and Phase in Feedback Amplifier				
Design—H. W. Bode				
Analysis of the Ionosphere—Karl K. Darrow	455			
OCTOBER, 1940				
The Carrier Nature of Speech—Homer Dudley	495			
Manufacture of Quartz Crystal Filters—G. K. Burns				
Results of the World's Fair Hearing Tests—				
J. C. Steinberg, H. C. Montgomery and M. B. Gardner	533			
The Subjective Sharpness of Simulated Television Images—				
Millard W. Baldwin, Jr.				
Cross-Modulation Requirements on Multichannel Amplifiers Below				
Overload-W. R. Bennett				
Radio Extension Links to the Telephone System—R. A. Heising	611			

# Volume XX, 1941

# JANUARY, 1941

ps 262 

ge 200

. 306

. 341

Single Sampling and Double Sampling Inspection Tables—	
H. F. Dodge and H. G. Romig	1
Television Transmission Over Wire Lines-	
M. E. Strieby and J. F. Wentz	62
Insulation of Telephone Wire with Paper Pulp-J. S. Little	82
Design and Operation of New Copper Wire Drawing Plant:	
Part I—Design and Operation of High Speed Copper Wire Drawing	
Machines—H. Blount	95
Part II—Equipping and Operating the New Wire Mill—	
J. E. Wiltrakis	111

# APRIL, 1941

Steady State Solutions of Transmission Line Equations—S. O. Rice.	131
Engineering Problems in Dimensions and Tolerances-W. W. Werring	
Time Division Multiplex Systems—W. R. Bennett	199
Steady State Delay as Related to Aperiodic Signals-R. V. L. Hartley	222
Engineering Requirements for Program Transmission Circuits-	
E A Coman P C McCurdy and I E Latimer	225

# JULY, 1941

Industrial Mathematics—Thornton C. Fry	255
The Transmission Characteristics of Toll Telephone Cables at Carrier	
Frequencies—C. M. Hebbert	293
Some Analyses of Wave Shapes Used in Harmonic Producers-	
F. R. Stansel	331
Forces and Atoms: The World of the Physicist - Karl K. Darrow	340

# OCTOBER, 1941

The Reliability of Holding Measurements—Roger I. Wilkinson	365
Electrical and Mecahnical Analogies-W. P. Mason	405
The History of Electrical Resonance—Julian Blanchard	415
A Rapid Visual Test for the Quantitative Determination of Small Con-	
contrations of Calcium in Lead-	

Earle E. Schumacher and G. M. Bouton 434

Acous Acous Affel,

Affel,

Affel, Aiken

Air T Alloy

Alloy:

Altim A mac

Amp

Amp

Amp Amp

Amp

Amp

Amp

Amp Anal Anal

# INDEX

# Volumes XI-XX

(1932-1941)

Abraham, L. G., Toll Transmission, Vol. XII, page 517.

Circulating Currents and Singing on Two-Wire Cable Circuits, Vol. XIV, page 600.

Acoustical Instruments, E. C. Wente, Vol. XIV, page 388.

Acoustic Impedance, A Method of Measuring, P. B. Flanders, Vol. XI, page 402.

Affel, H. A., Transmitted Frequency Range for Circuits in Broad-Band Systems, Vol. XVI, page 487.

Affel, H. A., R. W. Chesnut and R. H. Mills, Transmission Lines, Vol. XIII, page 285.
Affel, H. A., W. S. Gorton and R. W. Chesnut, A New Key West-Havana Carrier Telephone Cable, Vol. XI, page 197.
Affel, H. A., and B. W. Kendall, A Twelve-Channel Carrier Telephone System for Open-

Wire Lines, Vol. XVIII, page 119.

Aiken, C. B., The Effect of Background Noise in Shared Channel Broadcasting, Vol. XIII, page 333.

Air Transportation, Wire Communication Aids to, H. H. Nance, Vol. XI, page 462.

Alloy: Corrosion of Metals-II. Lead and Lead-Alloy Cable Sheathing, R. M. Burns, Vol. XV, page 603.

Alloys, Lead-Calcium, Superiorities of for Storage Battery Construction (a Digest), H. E. Haring, U. B. Thomas, E. E. Schumacher and G. S. Phipps, Vol. XIV, page 699. Alloys, Magnetic, of Iron, Nickel, and Cobalt, G. W. Elmen, Vol. XV, page 113.

Almquist, M. L., H. J. Fisher and R. H. Mills, A New Single Channel Carrier Telephone

System, Vol. XVII, page 162.

Altimeter: A Terrain Clearance Indicator, Lloyd Espenschied and R. C. Newhouse, Vol. XVIII, page 222

Amadon, C. H. and R. H. Colley, The Relation between Penetration and Decay in Creo-

soted Southern Pine Poles, Vol. XV, page 363.

Amplification, Limits to, J. B. Johnson and F. B. Llewellyn, Vol. XIV, page 85.

Amplifier for Modulated Waves, A New High-Efficiency Power (a Digest), W. H. Doherty, Vol. XV, page 469.

Amplifier for Ultra-High Frequencies, A Power, A. L. Samuel and N. E. Sowers, Vol. XVI, page 10.

Amplifier for Ultra-High Frequencies, A Negative Grid Triode Oscillator and (a Digest), A. L. Samuel, Vol. XVI, page 568.

Amplifier Design, Feedback, Relations between Attenuation and Phase in, H. W. Bode, Vol. XIX, page 421. Amplifiers, E. O. Scriven, Vol. XIII, page 278.

Amplifiers, Class B and Class C, The Operation of Vacuum Tubes as, C. E. Fay, Vol. XI page 28

Amplifiers, High-Frequency, Transformer Coupling Circuits for, A. J. Christopher, Vol. XI, page 608

Amplifiers, Multi-Channel, Load Rating Theory for, B. D. Holbrook and J. T. Dixon, Vol. XVIII, page 624.

Amplifiers, Multichannel, Below Overload, Cross-Modulation Requirements on, W. R. Bennett, Vol. XIX, page 587. Amplifiers, Stabilized Feedback, H. S. Black, Vol. XIII, page 1.

Amplitude Characteristics of Telephonic Signals, Devices for Controlling, A. C. Norwine, Vol. XVII, page 539.

Amplitude Range Control, S. B. Wright, Vol. XVII, page 520.

Analogies, Electrical and Mechanical, W. P. Mason, Vol. XX, page 405.

Analyzer, An Optical Harmonic, H. C. Montgomery, Vol. XVII, page 406.

- Anderson, C. N., A Representation of the Sunspot Cycle, Vol. XVIII, page 292.
- Antenna for Short-Wave Reception, A Multiple Unit Steerable, H. T. Friis and (B. Feldman, Vol. XVI, page 337.

Blount,

Boardm

Bode, I.

Va Bode, I Booth,

Booth,

Bostor

Boutor Bowen

Bown.

Bosort

Bozori

Bridg

Broad

Broad

Brobs

Bron

Bruc

Bruc

Burn

Burn

Burn

Bur

Bur

Bu

Bu

Bu

Ca

Ca

- Antennas, Horizontal Rhombic, E. Bruce, A. C. Beck and L. R. Lowry, Vol. XIV, page 135.

  Anti-sidetone Subscriber Set, Common Battery, An Explanation of the, C. O. Gilbon,
  Vol. XVII, page 245.
- Articulation Testing, Developments in the Application of, T. G. Castner and C. W. Carler, Jr., Vol. XII, page 347.
- Atmospherics, Audio Frequency, E. T. Burton and E. M. Boardman, Vol. XII, page 408, Atoms, Forces and: The World of the Physicist, Karl K. Darrow, Vol. XX, page 340, Audio Frequency Atmospherics, E. T. Burton and E. M. Boardman, Vol. XII, page 498.
- Audio Frequency Atmospherics, E. T. Burton and E. M. Boardman, Vol. XII, page 498.
  Auditory Perspective, Symposium on Wire Transmission of Symphonic Music and Its Reproduction in, Vol. XIII, pages 239–301.
- Avery, C. R. and H. Kress, Cellulose Acetate Treatment for Textile Insulation—Development of the Manufacturing Process, Vol. XI, page 231.
- Aykroyd, M. J. and D. G. Geiger, The Toronto-Barrie Toll Cable, Vol. XVIII, page 588.

### F

- Bailey, Austin and A. E. Harper, Long-Wave Radio Transmission Phenomena Associated with a Cessation of the Sun's Rays, Vol. XV, page 1.
- Bailey, Austin and H. M. Thomson, Transatlantic Long-Wave Transmission, Vol. XIV, page 680.
- Balanced Circuits, Wide Band Transmission Over, A. B. Clark, Vol. XIV, page 1.
- Baldwin, Millard W., Jr., The Subjective Sharpness of Simulated Television Images, Vol. XIX, page 563.
- Barstow, J. M., P. W. Blye and H. E. Kent, Measurement of Telephone Noise and Power Wave Shape (a Digest), Vol. XV, page 151.
- Basic Requirements (of Wire Transmission of Symphonic Music and Its Reproduction in Auditory Perspective), Harvey Fletcher, Vol. XIII, page 239.
- Battery Construction, Storage, Superiorities of Lead-Calcium Alloys for (a Digest), H. F. Haring, U. B. Thomas, E. E. Schumacher and G. S. Phipps, Vol. XIV, page 699.
- Beck, A. C. and E. Bruce. Experiments with Directivity Steering for Fading Reduction. Vol. XIV, page 195.
- Beck, A. C., E. Bruce and L. R. Lowry, Horizontal Rhombic Antennas, Vol. XIV, page 135.
  Becker, J. A., Thermionic Electron Emission, Vol. XIV, page 413.
- Bedell, E. H. and Iden Kerney, System Adaptation (of Symphonic Music and Its Reproduction in Auditory Perspective), Vol. XIII.
- page 301.

  Bedell, W. B., G. B. Ransom and W. A. Stevens, Experience in Applying Carrier Telephone
- Systems to Toll Cables, Vol. XVIII, page 547.

  Remis F. W. and R. F. Pierre, A. Transmission System for Taletynowriter Evolunce Sec.
- Bemis, É. W. and R. E. Pierce, A Transmission System for Teletypewriter Exchange Service, Vol. XV, page 529.
  Bennett, W. R., New Results in the Calculation of Modulation Products, Vol. XII, page 228.
- Bennett, W. R., New Results in the Calculation of Modulation Products, Vol. XII, page 228.
  Cross-Modulation Requirements on Multichannel Amplifiers Below Overload, Vol. XIX, page 587.
- Time Division Multiplex Systems, Vol. XX, page 199.

  Bennett, William R. and Robert M. Kalb, Ferromagnetic Distortion of a Two-Frequency
- Wave, Vol. XIV, page 322.

  Best, F. H., New Transmission Measuring Systems for Telephone Circuit Maintenance,
- Vol. XVII, page 1.

  A Recording Transmission Measuring System for Telephone Circuit Testing, Vol.
- XII, page 22.

  Beyer, J. W., J. T. O'Leary and E. C. Blessing, An Improved Three-Channel Carrier
- Beyer, J. W., J. I. U Leary and E. C. Biessing, An Improved Three-Channel Carri Telephone System, Vol. XVIII, page 49.
- Black, H. S., Stabilized Feedback Amplifiers, Vol. XIII, page 1.
  Blackwell, O. B., The Time Factor in Telephone Transmission, Vol. XI, page 53.
  Blackwell Inling The History of Flectrical Resonance, Vol. XV, page 415.
- Blanchard, Julian, The History of Electrical Resonance, Vol. XX, page 415. Hertz, the Discoverer of Electric Waves, Vol. XVII, page 327.
- Blessing, E. C., J. T. O'Leary and J. W. Beyer, An Improved Three-Channel Carrier Telephone System, Vol. XVIII, page 49.

Blount, H., Part I of Design and Operation of New Copper Wire Drawing Plant, Vol. XX,

Blye, P. W., J. M. Barstow and H. E. Kent, Measurement of Telephone Noise and Power Wave Shape (a Digest), Vol. XV, page 151.

Boardman, E. M. and E. T. Burton, Audio Frequency Atmospherics, Vol. XII, page 498. Bode, H. W., Relations Between Attenuation and Phase in Feedback Amplifier Design, Vol. XIX, page 421.

A General Theory of Electric Wave Filters, Vol. XIV, page 211.

Variable Equalizers, Vol. XVII, page 229.

Bode, H. W. and R. L. Dietzold, Ideal Wave Filters, Vol. XIV, page 215.
Booth, R. P. and R. N. Hunter, Cable Crosstalk—Effect of Non-Uniform Current Distribution in the Wires, Vol. XIV, page 179.

Booth, R. P. and T. M. Odarenko, Crosstalk between Coaxial Conductors in Cable, Vol. XIX, page 358.

Boston Harbor, Marine Radio Telephone Service for (a Digest), F. A. Gifford and R. B. Meader, Vol. XIV, page 702.
 Boulon, G. M. and Earle E. Schumacher, A Rapid Visual Test for the Quantitative Deter-

mination of Small Concentrations of Calcium in Lead, Vol. XX, page 434.

Bowen, A. E. and F. B. Llewellyn, The Production of Ultra-High-Frequency Oscillations by Means of Diodes, Vol. XVIII, page 280.

Bown, Ralph, Transoceanic Radio Telephone Development (a Digest), Vol. XVI, page 560. Bozorth, R. M., The Present Status of Ferromagnetic Theory, Vol. XV, page 63.

Bozorth, R. M., The Physical Basis of Ferromagnetism, Vol. XIX, page 1.

Bridge Methods of Measuring Impedances, Classification of, John G. Ferguson, Vol. XII, page 452. Broad-Band Wire Transmission Circuits, Irregularities in, P. Mertz and K. W. Pfleger,

Vol. XVI, page 541.

arter,

e 498.

588

VIV.

Iges.

tion

E

ion,

35

III.

me

er

28

e,

1.

27

Broad-Band Systems, Transmitted Frequency Range for Circuits in, II. A. Affel, Vol.

XVI, page 487 Broadcasting, Shared Channel, The Effect of Background Noise in, C. B. Aiken, Vol.

XIII, page 333. Brobst, D. R. and E. B. Wood, Cellulose Acetate Treatment for Textile Insulation-Engineering Development, Vol. XI, page 213.

Bronson, F. M., Tandem Operation in the Bell System, Vol. XV, page 380.
Bruce, E. and A. C. Beck, Experiments with Directivity Steering for Fading Reduction, Vol. XIV, page 195.

Bruce, E., A. C. Beck and L. R. Lowry, Horizontal Rhombic Antennas, Vol. XIV, page 135. Burns, G. K., Manufacture of Quartz Crystal Filters, Vol. XIX, page 516.

Burns, R. M., The Corrosion of Metals-I. Mechanism of Corrosion Processes, Vol. XV.

page 20. Burns, R. M., Corrosion of Metals-II. Lead and Lead-Alloy Cable Sheathing, Vol. XV.

page 603. Burns, R. M. and H. E. Haring, Determination of the Corrosion Behavior of Painted Iron

and the Inhibitive Action of Paints (a Digest), Vol. XV, page 343. Burrows, Charles R., Radio Propagation over Plane Earth-Field Strength Curves, Vol.

XVI, page 45 Addendum to "Radio Propagation over Plane Earth-Field Strength Curves," Vol. XVI, page 574.

Radio Propagation over Spherical Earth, Vol. XIV, page 477. The Exponential Transmission Line, Vol. XVII, page 555.

Burrows, C. R., E. B. Ferrell and J. C. Schelleng, Ultra-Short Wave Propagation, Vol. XII, page 125.

Burrows, C. R., L. E. Hunt and A. Decino, Ultra-Short-Wave Propagation: Mobile Urban Transmission Characteristics, Vol. XIV, page 253.
Burton, E. T. and E. M. Boardman, Audio Frequency Atmospherics, Vol. XII, page 498.

Cable Carrier Telephone System, Crosstalk and Noise Features of, M. A. Weaver, R. S-Tucker and P. S. Darnell, Vol. XVII, page 137.

Cable Carrier Telephone Terminals, R. W. Chesnut L. M. Ilgenfritz and A. Kenner, Vol. XVII, page 106.

Cable Carrier System, Crystal Channel Filters for the, C. E. Lane, Vol. XVII, page 12 Cable Circuits, Two-Wire, Circulating Currents and Singing on, L. G. Abraham, Vol. XIV.

Carrie

Carrie

Carrie

Carrie

Carrie

Carri

Carri

Carri

Carri

Carr

Carr

Cars

Cars

Cars

Car

Car

Cas

Cat

Ca

Cel

Ce

Ce

Ch

Ch CI

CI

C

C

page 600.

Cable Crosstalk—Effect of Non-Uniform Current Distribution in the Wires, R. N. Hunder and R. P. Booth, Vol. XIV, page 179.

Cable Sheathing, Lead and Lead-Alloy. The Corrosion of Metals—II, R. M. Burns

Vol. XV, page 603. Cable System for Television Transmission, Coaxial, M. E. Strieby, Vol. XVII, page 438. Cable, Carrier in, A. B. Clark and B. W. Kendall, Vol. XII, page 251.

Cable, A New Key West-Havana Carrier Telephone, H. A. Affel, W. S. Gorton and R. III. Chesnut, Vol. XI, page 197

Cable, Toll, The Toronto-Barrie, M. J. Aykroyd and D. G. Geiger, Vol. XVIII, page 588 Cable, Crosstalk between Coaxial Conductors in, R. P. Booth and T. M. Odarenko, Vol. XIX, page 358.

Cable, Telephone, Electrical Drying of, L. G. Wade, Vol. XIX, page 209.

Cable, Long Distance Telephone Circuits in, A. B. Clark and H. S. Osborne, Vol. XI, page

Cables, Coaxial, Crosstalk in-Analysis Based on Short-Circuited and Open Tertiaries. K. E. Gould, Vol. XIX, page 341.

Cables, Telephone, An Application of Number Theory to the Splicing of, H. P. Lauther Jr., Vol. XIV, page 273.

Cables, Telephone, Pulp Insulation for, H. G. Walker and L. S. Ford, Vol. XII, page 1 Cables, Toll, A Carrier Telephone System for, C. W. Green and E. I. Green, Vol. XVII.

page 80.
Cables, Toll, Experience in Applying Carrier Telephone Systems to, W. B. Bedell, G. B. Ransom and W. A. Stevens, Vol. XVIII, page 547.

Cables at Carrier Frequencies, Toll Telephone, The Transmission Characteristics of, C. M. Hebbert, Vol. XX, page 293.

Caesium-Oxygen-Silver Photoelectric Cell, The, C. H. Prescott, Jr. and M. J. Kelly, Vol.

XI, page 334.

Calcium in Lead, A Rapid Visual Test for the Quantitative Determination of Small Concentrations of, Earle E. Schumacher and G. M. Bouton, Vol. XX, page 434. Campbell, Dr. George A., F. B. Jewett, Vol. XIV, page 553. Campbell's Memoranda of 1907 and 1912, Dr., Vol. XIV, page 558.

Carbon Microphones and Other Granular Resistances, Spontaneous Resistance Fluctuations in, C. J. Christensen and G. L. Pearson, Vol. XV, page 197

Card, R. H., Earth Resistivity and Geological Structure (a Digest), Vol. XV, page 167. Carr, J. A., Forces of Oblique Winds on Telephone Wires, Vol. XV, page 587.

Carr, J. A. and F. V. Haskell, Studies of Telephone Line Wire Spacing Problems, Vol. XVII, page 195.

Carrier in Cable, A. B. Clark and B. W. Kendall, Vol. XII, page 251. Carrier Frequencies, The Transmission Characteristics of Toll Telephone Cables at, C. M. Hebbert, Vol. XX, page 293.

Carrier Nature of Speech, The, Homer Dudley, Vol. XIX, page 495.
Carrier System, Cable, Crystal Channel Filters for the, C. E. Lane, Vol. XVII, page 125.
Carrier System, Twelve-Channel Open-Wire, Line Problems in the Development of the,
L. M. Ilgenfritz, R. N. Hunter and A. L. Whitman, Vol. XVIII, page 363.
Carrier System, Type "J", Some Applications of the, L. C. Starbird and J. D. Mathis,

Vol. XVIII, page 338.

Carrier Systems, Precision Methods Used in Constructing Electric Wave Filters for, G. R. Harris, Vol. XI, page 264.

Carrier Telegraph Transmission, Advances in, A. L. Matte, Vol. XIX, page 161.

Carrier Telephone Cable, A New Key West-Havana, H. A. Affel, W. S. Gorton and R. W. Chesnut, Vol. XI, page 197.

Carrier Telephone System, Cable, Crosstalk and Noise Features of, M. A. Weaver, R. S. Tucker and P. S. Darnell, Vol. XVII, page 137.

Carrier Telephone System for Tolf Cables, A, C. W. Green and E. I. Green, Vol. XVII, page 80.

Carrier Telephone System, A New Single Channel, H. J. Fisher, M. L. Almquist and R. H. Mills, Vol. XVII, page 162.

Carrier Telephone System, An Improved Three-Channel, J. T. O'Leary, E. C. Blessing and J. W. Beyer, Vol. XVIII, page 49.

Carrier Telephone System, A Twelve-Channel, for Open-Wire Lines, B. W. Kendall and H. A. Affel, Vol. XVIII, page 119.

Carrier Telephone Systems, Copper Oxide Modulators in, R. S. Caruthers, Vol. XVIII,

Carrier Telephone Systems, Experience in Applying to Toll Cables, W. B. Bedell, G. B. Ransom and W. A. Stevens, Vol. XVIII, page 547.

Carrier: A Million-Cycle Telephone System, M. E. Strieby, Vol. XVI, page 1.

Carrier: Coaxial Cable System for Television Transmission, M. E. Strieby, Vol. XVII, page 438.

Carrier: Recent Trends in Toll Transmission in the United States, Edwin H. Colpitts, Vol. XVI, page 119.

Carrier: Hyper-Frequency Wave Guides-General Considerations and Experimental Results, G. C. Southworth, Vol. XV, page 284. Carrier: Hyper-Frequency Wave Guides—Mathematical Theory, John R. Carson, Sallie

XIV.

115 11.

3.8

Vol.

Dage

ries,

ther

VII.

B.

M

la-

ol.

1

s,

P. Mead and S. A. Schelkunoff, Vol. XV, page 310.
Carrier: The Use of Coaxial and Balanced Transmission Lines in Filters and Wide-Band Transformers for High Radio Frequencies, W. P. Mason and R. A. Sykes, Vol. XVI, page 275

Carrier: Wide Band Transmission over Balanced Circuits, A. B. Clark, Vol. XIV, page 1. Carrier: Systems for Wide-Band Transmission over Coaxial Lines, L. Espenschied and M. E. Strieby, Vol. XIII, page 654.

Carson, John R., An Extension of Operational Calculus, Vol. XV, page 340. Frequency-Modulation: Theory of the Feedback Receiving Circuit, Vol. XVIII, page 395.

Carson, John R. and Thornton C. Fry, Variable Frequency Electric Circuit Theory with Application to the Theory of Frequency Modulation, Vol. XVI, page 513.

Carson, John R., Sallie P. Mead and S. A. Schelkunoff, Hyper-Frequency Wave Guides-Mathematical Theory, Vol. XV, page 310.

Carter, C. W. and T. G. Castner, Developments in the Application of Articulation Testing, Vol. XII, page 347

Caruthers, R. S., Copper Oxide Modulators in Carrier Telephone Systems, Vol. XVIII, page 315.

Castner, T. G. and C. W. Carter, Jr., Developments in the Application of Articulation Testing, Vol. XII, page 347

Cathode Ray Oscillograph, The, J. B. Johnson, Vol. XI, page 1. Cathode Sputtering—A Commercial Application, Hal F. Fruth, Vol. XI, page 283.

Cellulose Acetate Treatment for Textile Insulation—Engineering Development, E. B. Wood and D. R. Brobst, Vol. XI, page 213. Cellulose Acetate Treatment for Textile Insulation-Development of the Manufacturing

Process, C. R. Avery and H. Kress, Vol. XI, page 231. Ceramic Manufacturing Developments of the Western Electric Company Some, A. G. Johnson and L. I. Shaw, Vol. XVIII, page 255.

Chaffee, J. G., The Application of Negative Feedback to Frequency-Modulation Systems, Vol. XVIII, page 404.

Chapman, A. G., Open-Wire Crosstalk, Vol. XIII, pages 19 and 195.
Chesnut, R. W., H. A. Affel and R. H. Mills, Transmission Lines, Vol. XIII, page 285.
Chesnut, R. W., W. S. Gorton and H. A. Affel, A New Key West-Havana Carrier Telephone

Cable, Vol. XI, page 197

Chesnut, R. W., L. M. Ilgenfritz and A. Kenner, Cable Carrier Telephone Terminals, Vol. XVII, page 106.

Chinn, H. A., D. K. Gannett and R. M. Morris, A New Standard Volume Indicator and

Reference Level, Vol. XIX, page 94.

Christensen, C. J. and G. L. Pearson, Spontaneous Resistance Fluctuations in Carbon Microphones and Other Granular Resistances, Vol. XV, page 197.

Christopher, A. J., Transformer Coupling Circuits for High-Frequency Amplifiers, Vol. XI, page 608.

Circuit Theory, Variable Frequency Electric, with Application to the Theory of Frequency Modulation, John R. Carson and Thornton C. Fry, Vol. XVI, page 513.
Circuits in Broad-Band Systems, Transmitted Frequency Range for, H. A. Affel, Vol.

XVI, page 487. Clark, A. B., Wide Band Transmission Over Balanced Circuits, Vol. XIV, page 1. Clark, A. B. and B. W. Kendall, Carrier in Cable, Vol. XII, page 251.

Clark, A. B. and H. S. Osborne, Long Distance Telephone Circuits in Cable, Vol. No.

Cosmic

Cotton,

Cowan,

Cowan,

Crawfor

Fu

U

Crossb

Crosst

Crossi

Crosst

Crossi

Cross

Cryst

Cryst

Cryst

Crys Crys

Crys

Crys Curr

Curt

Curi

Cyc

Dan

Das

Clarke, Beverly L. and H. W. Hermance, Microchemical and Special Methods of Analysis in Communication Research, Vol. XV, page 483.

Clarke, Beverly L. and A. E. Ruehle, Spectrochemical Analysis in Communication Research, Vol. XVII, page 381.

Clarke, W. J. and J. R. Townsend, Plastic Materials in Telephone Use, Vol. XVIII, page 482. Clearance Indicator, A Terrain, Lloyd Espenschied and R. C. Newhouse, Vol. XVIII

page 222

Clement, A. W., Line Filter for Program System, Vol. XIII, page 382.

Clutch, Dial, of the Spring Type, C. F. Wiebusch, Vol. XVIII, page 724. Coaxial: Irregularities in Broad-Band Wire Transmission Circuits, P. Mertz and K. II. Pfleger, Vol. XVI, page 541.

Coaxial: A Million-Cycle Teiephone System, M. E. Strieby, Vol. XVI, page 1.

Coaxial: Television Transmission over Wire Lines, M. E. Strieby and J. F. Wentz, Vol. XX, page 62.

Coaxial Cable System for Television Transmission, M. E. Strieby, Vol. XVII, page 438. Coaxial Cables, Crosstalk in-Analysis Based on Short-Circuited and Open Tertiaries. K. E. Gould, Vol. XIX, page 341.
Coaxial Conductors in Cable, Crosstalk between, R. P. Booth and T. M. Odarenko, Vol.

XIX, page 358.

Coaxial Lines, Systems for Wide-Band Transmission over, L. Espenschied and M. E. Strieby, Vol. XIII, page 654.

Coaxial and Balanced Transmission Lines in Filters and Wide-Band Transformers for High Radio Frequencies, The Use of, W. P. Mason and R. A. Sykes, Vol. XVI.

Coaxial and Balanced Transmission Lines in Filters and Wide-Band Transformers for High Radio Frequencies, The Use of, W. P. Mason and R. A. Sykes, Vol. XVI. page 275.

Coaxial Transmission Lines, Crosstalk between, S. A. Schelkunoff and T. M. Odarenko. Vol. XVI, page 144.

Coaxial Transmission Lines and Cylindrical Shields, The Electromagnetic Theory of S. A. Schelkunoff, Vol. XIII, page 532.
Coleman, J. O'R. and R. F. Davis, The Inductive Coordination of Common-Neutral

Power Distribution Systems and Telephone Circuits, Vol. XVI, page 76.

Colley, R. H. and C. H. Amadon, The Relation between Penetration and Decay in Creosoted Southern Pine Poles, Vol. XV, page 363.
Colpitts, Edwin H., Recent Trends in Toll Transmission in the United States, Vol. XVI.

Scientific Research Applied to the Telephone Transmitter and Receiver, Vol. XVI.

page 251.

Compandor, The—An Aid Against Static in Radio Telephony, R. C. Mathes and S. B. Wright, Vol. XIII, page 315. Conception and Demonstration of Electron Waves, The, C. J. Davisson, Vol. XI, page

546. Condenser Microphone System, An Efficient Miniature, H. C. Harrison and P. B. Flanders. Vol. XI, page 451.

Constant Frequency Oscillators, F. B. Llewellyn, Vol. XI, page 67.

Contact Phenomena in Telephone Switching Circuits, A. M. Curtis, Vol. XIX, page 40 Contemporary Advances in Physics-See Darrow, Karl K., or Physics.

Copper Oxide Modulators in Carrier Telephone Systems, R. S. Caruthers, Vol. XVIII. page 315.

Coronaviser, The, an Instrument for Observing the Solar Corona in Full Sunlight, A. M. Skellett, Vol. XIX, page 249.

Corrosion of Metals, The-I. Mechanism of Corrosion Processes, R. M. Burns, Vol. XV, page 20.

Corrosion of Metals-II. Lead and Lead-Alloy Cable Sheathing, R. M. Burns, Vol. XV, page 603.

Corrosion Behavior of Painted Iron and the Inhibitive Action of Paints, Determination of the (a Digest), R. M. Burns and H. E. Haring, Vol. XV, page 343.

Cory, S. I., R. B. Shanck and F. A. Cowan, Recent Developments in the Measurement of Telegraph Transmission, Vol. XVIII, page 143.
Cosmic Rays, Particles of the. Contemporary Advances in Physics, XXXII, Karl K.

Darrow, Vol. XVIII, page 190.

Ily sis

Re

11

Vol.

138

ies.

Vol

E

VI.

for

VI,

ko,

of.

al

0

1. I. Cotton, Effect of Atmospheric Humidity and Temperature on the Relation between Moisture Content and Electrical Conductivity of, A. C. Walker, Vol. XII, page 431.

Cowan, F. A., R. G. McCurdy and I. E. Laltimer, Engineering Requirements for Program Transmission Circuits, Vol. XX, page 235.

Cowan, F. A., R. B. Shanck and S. I. Cory, Recent Developments in the Measurement of Telegraph Transmission, Vol. XVIII, page 143.

Crawford, A. B., C. R. England and W. W. Mumford, Some Results of a Study of Ultra-

Short Wave Transmission Phenomena, Vol. XII, page 197.

Further Results of a Study of Ultra-Short-Wave Transmission Phenomena, Vol. XIV, page 369

Ultra-Short-Wave Transmission and Atmospheric Irregularities, Vol. XVII, page

489. Crossbar Dial Telephone Switching System, F. J. Scudder and J. N. Reynolds, Vol. XVIII,

page 76. Crosstalk, Cable-Effect of Non-Uniform Current Distribution in the Wires, R. N.

Hunter and R. P. Booth, Vol. XIV, page 179. Crosstalk, Open-Wire, A. G. Chapman, Vol. XIII, pages 19 and 195.

Crosstalk in Coaxial Cables-Analysis Based on Short-Circuited and Open Tertiaries, K. E. Gould, Vol. XIX, page 341

Crosstalk between Coaxial Conductors in Cable, R. P. Booth and T. M. Odarenko, Vol. XIX, page 358.

Crosstalk between Coaxial Transmission Lines, S. A. Schelkunoff and T. M. Odarenko, Vol. XVI, page 144.

Crystal, Piezoelectric, An Electromechanical Representation of a (a Digest), W. P. Mason, Vol. XIV, page 718.

Crystal Channel Filters for the Cable Carrier System, C. E. Lane, Vol. XVII, page 125. Crystal Filters for Use in Unbalanced Circuits, Resistance Compensated Band-Pass, W. P. Mason, Vol. XVI, page 423.

Crystal Filters, Quartz, Manufacture of, G. K. Burns, Vol. XIX, page 516.

Crystals, The Energies of Electrons in—The Quantum Physics of Solids, I. W. Shockley. Vol. XVIII, page 645

Crystals with Normal and Divided Electrodes, Electrical Wave Filters Employing, W. P. Mason and R. A. Sykes, Vol. XIX, page 221.

Crystals, Quartz, Low Temperature Coefficient, W. P. Mason, Vol. XIX, page 74.

Current Distribution in the Wires, Non-Uniform, Effect of—Cable Crosstalk, R. N. Hunter and R. P. Booth, Vol. XIV, page 179.

Curtis, A. M., Contact Phenomena in Telephone Switching Circuits, Vol. XIX, page 40.

An Oscillograph for Ten Thousand Cycles, Vol. XII, page 76.

Curtis, H. E., E. I. Green and F. A. Leibe, The Proportioning of Shielded Circuits for Minimum High-Frequency Attenuation, Vol. XV, page 248.

Cycle, A Million-, Telephone System, M. E. Strieby, Vol. XVI, page 1.

Darnell, P. S., M. A. Weaver and R. S. Tucker, Crosstalk and Noise Features of Cable Carrier Telephone System, Vol. XVII, page 137.

Darrow, Karl K., Contemporary Advances in Physics:

XXIII. Data and Nature of Cosmic Rays, Vol. XI, page 148. XXIV. High-Frequency Phenomena in Gases, First Part, Vol. XI, page 576. XXV. High-Frequency Phenomena in Gases, Second Part, Vol. XII, page 91. XXVI. The Nucleus, First Part, Vol. XII, page 288.

XXVII. The Nucleus, Second Part, Vol. XIII, page 102.
XXVIII. The Nucleus, Third Part, Vol. XIII, pages 391 and 580.
XXIX. The Nucleus, Fourth Part, Vol. XIV, page 285.
XXX. The Theory of Magnetism, Vol. XV, page 224.

XXXI. Spinning Atoms and Spinning Electrons, Vol. XVI, page 319.

XXXII. Particles of the Cosmic Rays, Vol. XVIII, page 190.

Electro

Electro Electro Electro

Electro

Electro

Electro

Electro

Ellis,

Ellwoo

Elmen

Emlin

Englu

Equa Equi

Esper

Esper

Expa

Fadi

Fair

Fay

Fay

Fee

Fee

Fee

Fee

Fel

Fel Fe

Fe

F

I

M

Forces and Atoms: The World of the Physicist, Vol. XX, page 340. Nuclear Fission, Vol. XIX, page 267

Analysis of the Ionosphere, Vol. XIX, page 455.
Radioactivity—Artificial and Natural, Vol. XVII, page 292.

Davis, R. F. and J. O'R. Coleman, The Inductive Coordination of Common-Neutral Power Distribution Systems and Telephone Circuits, Vol. XVI, page 76.

Davis, R. F. and H. R. Huntley, Some Theoretical and Practical Aspects of Noise Induction. Vol. XII, page 469.

Davisson, C. J., The Conception and Demonstration of Electron Waves, Vol. XI, page

546. The Discovery of Electron Waves, Vol. XVII, page 475.

Decino, A., C. R. Burrows and L. E. Hunt, Ultra-Short-Wave Propagation: Mobile Urban Transmission Characteristics, Vol. XIV, page 253. Development of a Handset for Telephone Stations, The, W. C. Jones and A. H. Inglis,

Vol. XI, page 245.

Dial Clutch of the Spring Type, C. F. Wiebusch, Vol. XVIII, page 724.

Dial Telephone Switching System, Crossbar, F. J. Scudder and J. N. Reynolds, Vol. XVIII, page 76.

Dielectric Properties of Insulating Materials, The, E. J. Murphy and S. O. Morgan, Vol. XVI, page 493.

Dielectric Properties of Insulating Materials, The, E. J. Murphy and S. O. Morgan, Vol. XVII, page 640.

Dielectric Properties of Insulating Materials, The, E. J. Murphy and S. O. Morgan,

Vol. XVIII, page 502.

Dietze, E. and W. D. Goodale, Jr., The Computation of the Composite Noise Resulting from Random Variable Sources, Vol. XVIII, page 605.

Dietzold, R. L. and H. W. Bode, Ideal Wave Filters, Vol. XIV, page 215.

Dimensions and Tolerances, Engineering Problems in, W. W. Werring, Vol. XX, page

Diodes, Effect of Space Charge and Transit Time on the Shot Noise in, A. J. Rack, Vol. XVII, page 592.

Diodes, The Production of Ultra-High-Frequency Oscillations by Means of, F. B. Llex ellyn and A. E. Bowen, Vol. XVIII, page 280.

Directivity Steering for Fading Reduction, Experiments with, E. Bruce and A. C. Beck. Vol. XIV, page 195

Dixon, J. T. and B. D. Holbrook, Load Rating Theory for Multi-Channel Amplifiers, Vol. XVIII, page 624.

Dodge, H. F. and H. G. Romig, Single Sampling and Double Sampling Inspection Tables.

Vol. XX, page 1.

Doherty, W. H., A New High-Efficiency Power Amplifier for Modulated Waves (a Digest). Vol. XV, page 469.

Drying, Electrical, of Telephone Cable, L. G. Wade, Vol. XIX, page 209. Dudley, Homer, The Carrier Nature of Speech, Vol. XIX, page 495.

### E

Ear for Telephone Measurements, A Voice and, A. H. Inglis, C. H. G. Gray and R. T. Jenkins, Vol. XI, page 293

Earth Resistivity and Geological Structure (a Digest), R. H. Card, Vol. XV, page 167. Echo Suppressors, Two, The Occurrence and Effect of Lockout Occasioned by, Arthur W. Horton, Jr., Vel. XVII, page 258.

Eclipse Effects in the Ionosphere (a Digest), J. P. Schafer and W. M. Goodall, Vol. XV.

page 162. Efficient Miniature Condenser Microphone System, An, H. C. Harrison and P. B. Flanders, Vol. XI, page 451.

Electric Circuit Theory, Variable Frequency, with Application to the Theory of Frequency Modulation, John R. Carson and Thornton C. Fry, Vol. XVI, page 513. Electric Waves, Hertz, the Discoverer of, Julian Blanchard, Vol. XVII, page 327.

Electromagnetic Theory of Coaxial Transmission Lines and Cylindrical Shields, The, S. A. Schelkunoff, Vol. XIII, page 532.

Electromagnetics and their Application to Radiation Problems, Some Equivalence Theorems of, S. A. Schelkunoff, Vol. XV, page 92.

Electromechanical System, Oscillations in an, L. W. Hussey and L. R. Wrathall, Vol. XV, page 441.

Electron Diffraction, An Interesting Application of (a Digest), L. H. Germer and K. H. Storks, Vol. XIX, page 152.

Electron-Optics, Electrostatic, Frank Gray, Vol. XVIII, page 1.

Electron Streams, Impedance Properties of, Liss C. Peterson, Vol. XVIII, page 465. Electron Waves, The Conception and Demonstration of, C. J. Davisson, Vol. XI, page 546.

Electron Waves, The Discovery of, C. J. Davisson, Vol. XVII, page 475.

Electronics—See Vacuum Tubes.

eutral

iction,

, Dage

nglis,

Vol.

Vol. Vol

rgan.

lting

rage

Vol.

eck.

ers.

St).

V,

e,

e

Electrons in Crystals, The Energies of—The Quantum Physics of Solids, I. W. Shockley, Vol. XVIII, page 645.

Ellis, W. C. and Earle E. Schumacher, A Survey of Magnetic Materials in Relation to Structure, Vol. XIV, page 8.

Metallic Materials in the Telephone System, Vol. XIX, page 138. Ellwood, W. B. and V. E. Legg, Study of Magnetic Losses at Low Flux Densities in Permalloy Sheet, Vol. XVI, page 212.

Elmen, G. W., Magnetic Alloys of Iron, Nickel and Cobalt, Vol. XV, page 113.
Emling, J. W. and F. W. McKown, A System of Effective Transmission Data for Rating Telephone Circuits, Vol. XII, page 331.

Englund, C. R., A. B. Crawford and W. W. Mumford, Some Results of a Study of Ultra-Short Wave Transmission Phenomena, Vol. XII, page 197.

Further Results of a Study of Ultra-Short-Wave Transmission Phenomena, Vol.

XIV, page 369. Ultra-Short-Wave Transmission and Atmospheric Irregularities, Vol. XVII, page 489.

Equalizers, Variable, H. W. Bode, Vol. XVII, page 229.

Equivalence Theorems of Electromagnetics and their Application to Radiation Problems,

Some, S. A. Schelkunoff, Vol. XV, page 92.

Espenschied, Lloyd and R. C. Newhouse, A Terrain Clearance Indicator, Vol. XVIII, page 222.

Espenschied, L. and M. E. Strieby, Systems for Wide-Band Transmission over Coaxial Lines, Vol. XIII, page 654.

Expansion, An, for Laplacian Integrals in Terms of Incomplete Gamma Functions, and Some Applications, E. C. Molina, Vol. XI, page 563.

Fading Reduction, Experiments with Directivity Steering for, E. Bruce and A. C. Beck,

Vol. XIV, page 195.
Fair, I. E., F. R. Lack and G. W. Willard, Some Improvements in Quartz Crystal Circuit Elements, Vol. XIII, page 453.

Fay, C. E., The Operation of Vacuum Tubes as Class B and Class C Amplifiers, Vol. XI, page 28. Fay, C. E., A. L. Samuel and W. Shockley, On the Theory of Space Charge between Parallel

Plane Electrodes, Vol. XVII, page 49.

Feedback, Negative, The Application of to Frequency-Modulation Systems, J. G. Chaffee, Vol. XVIII, page 404.

Feedback Amplifier Design, Relations between Attenuation and Phase in, H. W. Bode, Vol. XIX, page 421.

Feedback Oscillators, Stabilized, G. H. Stevenson, Vol. XVII, page 458.

Feedback Receiving Circuit, Theory of the. Frequency-Modulation: John R. Carson,

Vol. XVIII, page 395.
Feldman, C. B. and H. T. Friis, A Multiple Unit Steerable Antenna for Short-Wave Reception, Vol. XVI, page 337.

Feldman, C. B. and E. J. Sterba, Transmission Lines for Short-Wave Radio Systems, Vol. XI, page 411.

Ferguson, John G., Classification of Bridge Methods of Measuring Impedances, Vol. XII, page 452.

Ferrell, E. B., J. C. Schelleng and C. R. Burrows, Ultra-Short Wave Propagation, Vol. XII, page 125.

Ferris, L. P., B. G. King, P. W. Spence and H. B. Williams, Effect of Electric Shock on the Heart (a Digest), Vol. XV, page 455.

Freque

Freque

Freque

Freque

Friis,

Fruth,

Fry, T

Fry, T

Ganne Gans,

Gardi

Gases

Geige

Germ

Gher

Gher

Gibb

Giffe

Giffe Give

Good

Goo

Gor

Got

Got

Gro

Gre

Gre

Gr

Gr

Gi

G

Ferromagnetic Distortion of a Two-Frequency Wave, Robert M. Kalb and William R

Bennett, Vol. XIV, page 322.
Ferromagnetic Theory, The Present Status of, R. M. Bozorth, Vol. XV, page 63.

Ferromagnetism, The Physical Basis of, R. M. Bozorth, Vol. XIX, page 1,

Filter, Line, for Program System, A. W. Clement, Vol. XIII, page 382.

Filter Groups, Constant Resistance Networks with Applications to, E. L. Norton, Vol. XVI, page 178.

Filters, Resistance Compensated Band-Pass Crystal, for Use in Unbalanced Circuits W. P. Mason, Vol. XVI, page 423.

Filters, Crystal Channel, for the Cable Carrier System, C. E. Lane, Vol. XVII, page 125. Filters, Electric Wave, A General Theory of, H. W. Bode, Vol. XIV, page 211. Filters, Electric Wave, for Carrier Systems, Precision Methods Used in Constructing,

G. R. Harris, Vol. XI, page 264.

Filters, Electrical Wave, Employing Crystals with Normal and Divided Electrodes, W. P.

Mason and R. A. Sykes, Vol. XIX, page 221.

Filters, Electrical Wave, Employing Quartz Crystals as Elements, W. P. Mason, Vol. XIII, page 405.

Filters, Ideal Wave, H. W. Bode and R. L. Dietzold, Vol. XIV, page 215.

Filters, Quartz Crystal, Manufacture of, G. K. Burns, Vol. XIX, page 516.
Filters and Wide-Band Transformers for High Radio Frequencies, The Use of Coaxial and Balanced Transmission Lines in, W. P. Mason and R. A. Sykes, Vol. XVI.

Fisher, H. J., M. L. Almquist and R. H. Mills, A New Single Channel Carrier Telephone System, Vol. XVII, page 162.

Fission, Nuclear, Karl K. Darrow, Vol. XIX, page 267.

Flanders, P. B., A Method of Measuring Acoustic Impedance, Vol. XI, page 402.

Flanders, P. B. and H. C. Harrison, An Efficient Miniature Condenser Microphone System, Vol. XI, page 451.

Fletcher, Harvey, Basic-Requirements (of Wire Transmission of Symphonic Music and Its

Reproduction in Auditory Perspective), Vol. XIII, page 239. Fletcher, Harvey and W. A. Munson, Loudness, Its Definition, Measurement and Calcula-

tion, Vol. XII, page 377. Flood, and Hurricane-September 1938, W. H. Harrison, Vol. XVIII, page 218.

Forces and Atoms: The World of the Physicist, Karl K. Darrow, Vol. XX, page 340. Ford, L. S. and H. G. Walker, Pulp Insulation for Telephone Cables, Vol. XII, page 1. Foster, Ronald M., Mutual Impedance of Grounded Wires Lying On or Above the Surface

of the Earth, Vol. XII, page 264.

Frequency: Oscillations in an Electromechanical System, L. W. Hussey and L. R. Wrathall,

Vol. XV, page 441. Frequency: Oscillations in Systems with Non-Linear Reactance, R. V. L. Hartley, Vol.

XV, page 424. Frequency: Vacuum Tubes as High-Frequency Oscillators, M. J. Kelly and A. L. Samuel,

Vol. XIV, page 97. Frequency: Wide Band Transmission over Balanced Circuits, A. B. Clark, Vol. XIV.

Frequency Attenuation, Minimum High-, The Proportioning of Shielded Circuits for, E. I. Green, F. A. Leibe and H. E. Curtis, Vol. XV, page 248.

Frequency-Modulation, Variable Frequency Electric Circuit Theory with Application to the Theory of, John R. Carson and Thornton C. Fry, Vol. XVI, page 513.

Frequency-Modulation: Theory of the Feedback Receiving Circuit, John R. Carson, Vol. XVIII, page 395. Frequency-Modulation Systems, The Application of Negative Feedback to, J. G. Chaffee,

Vol. XVIII, page 404.

Frequency Vacuum Tubes, Ultra-High-, Operation of, F. B. Llewellyn, Vol. XIV, page

Frequency Wave Guides, Hyper-, -General Considerations and Experimental Results, G. C. Southworth, Vol. XV, page 284.

Frequency Wave Guides, Hyper-, —Mathematical Theory, John R. Carson, Sallie P. Meed and S. A. Schelkunoff, Vol. XV, page 310.

Frequencies, Extraneous, Generated in Air Carrying Intense Sound Waves, A. L. Thuras, R. T. Jenkins and H. T. O'Neil, Vol. XIV, page 159.

Frequencies, Ultra-High, A Power Amplifier for, A. L. Samuel and N. E. Sowers, Vol. XVI, page 10.

Frequencies, Ultra-High, A Negative Grid Triode Oscillator and Amplifier for (a Digest), A. L. Samuel, Vol. XVI, page 568.

Frequencies, Ultra-High, Equivalent Networks of Negative Grid Vacuum Tubes at, F. B. Llewellyn, Vol. XV, page 575.

Friis, H. T. and C. B. Feldman, A Multiple Unit Steerable Antenna for Short-Wave

Reception, Vol. XVI, page 337. Fruth, Hal F., Cathode Sputtering-A Commercial Application, Vol. XI, page 283.

Fry, Thornton C., Industrial Mathematics, Vol. XX, page 255.

Fry, T. C. and J. R. Carson, Variable Frequency Electric Circuit Theory with Application to the Theory of Frequency Modulation, Vol. XVI, page 513.

Gannett, D. K., H. A. Chinn and R. M. Morris, A New Standard Volume Indicator and Reference Level, Vol. XIX, page 94.

Ganz, A. G. and A. G. Laird, Improvements in Communication Transformers, Vol. XV, page 136.

Gardner, M. B., J. C. Steinberg and H. C. Montgomery, Results of the World's Fair Hearing

Tests, Vol. XIX, page 533.
Gases in Metals, Some Theoretical and Practical Aspects of, J. H. Scaff and E. E. Schu-

macher, Vol. XII, page 178

n R

Vol

125

Val.

ine

Its

r.

12.

Geiger, D. G. and M. J. Aykroyd, The Toronto-Barrie Toll Cable, Vol. XVIII, page 588. Geological Structure, Earth Resistivity and (a Digest), R. H. Card, Vol. XV, page 167. Germer, L. H. and K. H. Storks, An Interesting Application of Electron Diffraction (a Digest), Vol. XIX, page 152

Gherardi, Bancroft, Henry as an Electrical Pioneer, Vol. XI, page 327.

Gherardi, Bancroft and Frank B. Jewett, World-Wide Telephony-Its Problems and

Future, Vol. XI, page 485.

Gibbon, C. O., An Explanation of the Common Battery Anti-sidetone Subscriber Set, Vol. XVII, page 245.

Gifford, F. A. and R. B. Meader, Marine Radio Telephone Service for Boston Harbor (a Digest), Vol. XIV, page 702.

Gifford, W. S., Around the World by Telephone, Vol. XIV, page 542

Given, F. J. and V. E. Legg, Compressed Powdered Molybdenum Permalloy for High Quality Inductance Coils, Vol. XIX, page 385.

Goodale, W. D., Jr. and E. Dietze, The Computation of the Composite Noise Resulting

from Random Variable Sources, Vol. XVIII, page 605. Goodall, W. M. and J. P. Schafer, Eclipse Effects in the Ionosphere (a Digest), Vol. XV, page 162

Gorton, W. S., R. W. Chesnut and H. A. Affel, A New Key West-Havana Carrier Telephone

Cable, Vol. XI, page 197.

Goucher, F. S., The Carbon Microphone: An Account of Some Researches Bearing on its Action, Vol. XIII, page 163.

Gould, K. E., Crosstalk in Coaxial Cables-Analysis Based on Short-Circuited and Open Tertiaries, Vol. XIX, page 341.

Gray, C. H. G., R. T. Jenkins and A. II. Inglis, A Voice and Ear for Telephone Measurements, Vol. XI, page 293.

Gray, Frank, Electrostatic Electron-Optics, Vol. XVIII, page 1.

Gray, Frank and Pierre Mertz, A Theory of Scanning and Its Relation to the Characteristics of the Transmitted Signal in Telephotography and Television, Vol. XIII, page 464.

Green, C. W. and E. I., A Carrier Telephone System for Toll Cables, Vol. XVII, page 80. Green, E. I., F. A. Leibe and H. E. Curtis, The Proportioning of Shielded Circuits for Minimum High-Frequency Attenuation, Vol. XV, page 248.

Ground-Return Conductors, Leaky, Currents and Potentials along (a Digest), E. D.

Sunde, Vol. XVI, page 110. Grounded Wires for Horizontally Stratified Two-Layer Earth, John Riordan and Erling D. Sunde, Vol. XII, page 162.

Grounded Wires Lying On or Above the Surface of the Earth, Mutual Impedance of Ronald M. Foster, Vol. XII, page 264.

Hunt, 1

Hunter.

Hunter Huntle

Huntle

Hurric

Hussey Hussey

Ilgenfi

Ilgenf.

Imped

Impe

Impe

Impe

Impe

Indu

Indu

Ingli

Ingli

Ingli

Inst Insu

Inst

Inst Inst Inst Ins

> Ion Ion

> Int

Jei

Gustafson, W. G., Magnetic Shielding of Transformers at Audio Frequencies, Vol. XVII. page 416.

- Hamilton, H. S., Wide-Band Open-Wire Program System, Vol. XIII, page 351.
- Handset for Telephone Stations, The Development of a, W. C. Jones and A. H. Inglis, Vol. XI, page 245.
- Hansen, E. B., Harbor Craft Ship-to-Shore Radio Telephone Service in Puget Sound
- Area (a Digest), Vol. XIV, page 708.

  Haring, H. E. and R. M. Burns, Determination of the Corrosion Behavior of Painted Iron
- and the Inhibitive Action of Paints (a Digest), Vol. XV, page 343.

  Haring, H. E., U. B. Thomas, E. E. Schumacher and G. S. Phipps, Superiorities of Lead-
- Calcium Alloys for Storage Battery Construction (a Digest), Vol. XIV, page 699 Harmonic Producers, Some Analyses of Wave Shapes Used in, F. R. Stansel, Vol. XX
- Harper, A. E. and Austin Bailey, Long-Wave Radio Transmission Phenomena Associated with a Cessation of the Sun's Rays, Vol. XV, page 1.
- Harris, G. R., Precision Methods Used in Constructing Electric Wave Filters for Carrier Systems, Vol. XI, pa 264.
- Harrison, H. C. and P. B. F. rs, An Efficient Miniature Condenser Microphone System. Vol. XI, page 451.
- Harrison, W. H., Hurricane and Flood—September 1938, Vol. XVIII, page 218.
  Hartley, R. V. L., Oscillations in Systems with Non-Linear Reactance, Vol. XV, page
- Steady State Delay as Related to Aperiodic Signals, Vol. XX, page 222.
- Haskell, F. V. and J. A. Carr, Studies of Telephone Line Wire Spacing Problems, Vol. XVII, page 195.
- Hearing Tests, World's Fair, Results of, J. C. Steinberg, H. C. Montgomery and M. B.
- Gardner, Vol. XIX, page 533. Heart, Effect of Electric Shock on the (a Digest), L. P. Ferris, B. G. King, P. W. Spence
- and H. B. Williams, Vol. XV, page 455.

  Hebbert, C. M., The Transmission Characteristics of Toll Telephone Cables at Carrier
- Frequencies, Vol. XX, page 293.
- Heising, R. A., Radio Extension Links to the Telephone System, Vol. XIX, page 611.
- Henry as an Electrical Pioneer, Bancroft Gherardi, Vol. XI, page 327.
  Hermance, H. W. and Beverly L. Clarke, Microchemical and Special Methods of Analysis in Communication Research, Vol. XV, page 483.
- Hermitian-Laplace Functions of High Order, A Laplacian Expansion for, E. C. Molina, Vol. XV, page 355.

  Herriott, W., High Speed Motion Picture Photography, Vol. XVII, page 393.
- Hertz, the Discoverer of Electric Waves, Julian Blanchard, Vol. XVII, page 327.
- Heterodyne Oscillators, High Accuracy, T. Slonczewski, Vol. XIX, page 407.

- Heterodyne Oscillators, High Accuracy, I. Slonezwaski, Vol. XIX, page 407.
   Hickman, C. N., Sound Recording on Magnetic Tape, Vol. XVI, page 165.
   High-Frequency Attenuation, Minimum, The Proportioning of Shielded Circuits for, E. I. Green, F. A. Leibe and H. E. Curtis, Vol. XV, page 248.
   High-Frequency Vacuum Tubes, Ultra-, Operation of, F. B. Llewellyn, Vol. XIV, page 632.
   Hill, Caleb M., R. E. Waterman and John Leutritz, A Laboratory Evaluation of Wood Preservatives, Vol. XVI, page 194.
   History of Electrical Resonance, The, Julian Blanchard, Vol. XX, page 415.
   Holbrock B. D. and J. T. Divers, Local Rating Theory for Multi Channel Applifers.
- Holbrook, B. D. and J. T. Dixon, Load Rating Theory for Multi-Channel Amplifiers, Vol. XVIII, page 645.
- Holding Time Measurements, The Reliability of, Roger I. Wilkinson, Vol. XX, page 365. Horton, Arthur W., Jr., The Occurrence and Effect of Lockout Occasioned by Two Echo Suppressors, Vol. XVII, page 258.
- Hoyl, Ray S., Probability Theory and Telephone Transmission Engineering, Vol. XII,
- page 35. Hoyt, Ray S. and Sallie Pero Mead, Mutual Impedances of Parallel Wires, Vol. XIV, page 509
- Humidity and Temperature, Atmospheric, Effect of on the Relation between Moisture Content and Electrical Conductivity of Cotton, A. C. Walker, Vol. XII, page 431.

Hunt, L. E., C. R. Burrows and A. Decino, Ultra-Short-Wave Propagation: Mobile Urban Transmission Characteristics, Vol. XIV, page 253.

Hunter, R. N. and R. P. Booth, Cable Crosstalk—Effect of Non-Uniform Current Distri-

bution in the Wires, Vol. XIV, page 179.

Hunter, R. N., L. M. Ilgenfritz and A. L. Whitman, Line Problems in the Development of the Twelve-Channel Open-Wire Carrier System, Vol. XVIII, page 363. Huntley, H. R., and R. F. Davis, Some Theoretical and Practical Aspects of Noise In-

duction, Vol. XII, page 469.

ce of.

WII.

nglis.

ound Iron

ead-600 XX.

ated

rrier

tem.

age Vol.

. B.

nce

rier

11.

sis

na,

or,

32. od

rs,

55.

ho

II, V,

re

1.

Huntley, H. R. and E. J. O'Connell, Some Aspects of Low-Frequency Induction between Power and Telephone Circuits, Vol. XIV, page 573.

Hurricane and Flood—September 1938, W. H. Harrison, Vol. XVIII, page 218.

Hussey, L. W. and E. Peterson, Equivalent Modulator Circuits, Vol. XVIII, page 32.

Hussey, L. W. and L. R. Wrathall, Oscillations in an Electromechanical System, Vol. XV, page 441.

Ilgenfritz, L. M., R. W. Chesnut and A. Kenner, Cable Carrier Telephone Terminals, Vol-

XVII, page 106.

Ilgenfritz, L. M., R. N. Hunter and A. L. Whitman, Line Problems in the Development of the Twelve-Channel Open-Wire Carrier System, Vol. XVIII, page 363.

Impedance, Mutual, of Grounded Wires for Horizontally Stratified Two-Layer Earth,

John Riordan and Erling D. Sunde, Vol. XII, page 162. Impedance, Mutual, of Grounded Wires Lying On or Above the Surface of the Earth, Ronald M. Foster, Vol. XII, page 264.

Impedance Concept and its Application to Problems of Reflection, Refraction, Shielding and Power Absorption, The, S. A. Schelkunoff, Vol. XVII, page 17.
 Impedances, Classification of Bridge Methods of Measuring, John G. Ferguson, Vol.

XII, page 452. Impedances, Mutual, of Parallel Wires, Ray S. Hoyt and Sallie Pero Mead, Vol. XIV,

page 509. Inductance Coils, High Quality, Compressed Powdered Molybdenum Permalloy for, V. E. Legg and F. J. Given, Vol. XIX, page 385.

Induction, Low-Frequency, Some Aspects of between Power and Telephone Circuits, H. R. Huntley and E. J. O'Connell, Vol. XIV, page 573.

Inglis, A. H., Transmission Features of the New Telephone Sets, Vol. XVII, page 358. Inglis, A. H., C. H. G. Gray and R. T. Jenkins, A Voice and Ear for Telephone Measurements, Vol. XI, page 293. Inglis, A. H. and W. C. Jones, The Development of a Handset for Telephone Stations,

Vol. XI, page 245.

Instruments, Acoustical, E. C. Wente, Vol. XIV, page 388.

Insulating Materials, The Dielectric Properties of, I, E. J. Murphy and S. O. Morgan, Vol. XVI, page 493.

Insulating Materials, The Dielectric Properties of, II, E. J. Murphy and S. O. Morgan, Vol. XVII, page 640.

Insulating Materials, The Dielectric Properties of, III, E. J. Murphy and S. O. Morgan, Vol. XVIII, page 502.

Insulation of Telephone Wire with Paper Pulp, J. S. Little, Vol. XX, page 82.

Insulation, Textile, Cellulose Acetate Treatment for—Engineering Development, E. B. Wood and D. R. Brobst, Vol. XI, page 213.

Insulation, Textile, Cellulose Acetate Treatment for-Development of the Manufacturing Process, C. R. Avery and H. Kress, Vol. XI, page 231.

Ionosphere, Analysis of the, Karl K. Darrow, Vol. XIX, page 455.
Ionosphere, Eclipse Effects in the (a Digest), J. P. Schafer and W. M. Goodall, Vol. XV, page 162

Intense Sound Waves, Extraneous Frequencies Generated in Air Carrying, A. L. Thuras, R. T. Jenkins and H. T. O'Neil, Vol. XIV, page 159.

Jenkins, R. T., C. H. G. Gray and A. H. Inglis, A Voice and Ear for Telephone Measurements, Vol. XI, page 293.

Jenkins, R. T., A. L. Thuras and H. T. O'Neil, Extraneous Frequencies Generated in Air Carrying Intense Sound Waves, Vol. XIV, page 159, Jewett, F. B., Dr. George A. Campbell, Vol. XIV, page 553.

Lead-T

Legg, I

Legg. 1

Legg,

Leibe,

Leutri

Levin,

Line

Lines

Lines Little

Llewe

Llew

Llew

Load Load Lock

Lon

Lou Lou Low

Loy

Me

Me

Me

Ma

M

M

F

M

- Jewett, Frank B. and Bancroft Gherardi, World-Wide Telephony-Its Problems and Future,
- Vol. XI, page 485. Johnson, A. G. and L. I. Shaw, Some Ceramic Manufacturing Developments of the Western
- Electric Company, Vol. XVIII, page 255. Johnson, J. B., The Cathode Ray Oscillograph, Vol. XI, page 1.
- Johnson, J. B. and F. B. Llewellyn, Limits to Amplification, Vol. XIV, page 85.
- Jones, W. C., Instruments for the New Telephone Sets, Vol. XVII, page 338, Jones, W. C. and A. H. Inglis, The Development of a Heavilland Sets, Vol. XVIII, page 338, Jones, W. C. and A. H. Inglis, The Development of a Heavilland Sets of the New York (New York).
- and A. H. Inglis, The Development of a Handset for Telephone Stations, Vol. XI, page 245.

## K

- Kalb, Robert M. and William R. Bennett, Ferromagnetic Distortion of a Two-Frequency Wave, Vol. XIV, page 322
- Kelly, M. J. and C. H. Prescott, Jr., The Caesium-Oxygen-Silver Photoelectric Cell, Vol. XI, page 334.
- Kelly, M. J. and A. L. Samuel, Vacuum Tubes as High-Frequency Oscillators, Vol. XIV. page 97.
- Kendall, B. W., and H. A. Affel, A Twelve-Channel Carrier Telephone System for Open-Wire Lines, Vol. XVIII, page 119.

  Kendall, B. W. and A. B. Clark, Carrier in Cable, Vol. XII, page 251.
- Kenner, A., R. W. Chesnut and L. M. Ilgenfritz, Cable Carrier Telephone Terminals, Vol.
- XVII, page 106.

  Kent, H. E., J. M. Barstow and P. W. Blye, Measurement of Telephone Noise and Power Wave Shape (a Digest), Vol. XV, page 151.

  Kerney, Iden and E. II. Bedell, System Adaptation (of Symposium on Wire Transmission
- of Symphonic Music and Its Reproduction in Auditory Perspective), Vol. XIII, Page 301.
- Key West-Havana Carrier Telephone Cable, A New, H. A. A fiel, W. S. Gorton and R. W. Chesnut, Vol. XI, page 197
- King, B. G., L. P. Ferris, P. W. Spence and H. B. Williams, Effect of Electric Shock on the Heart (a Digest), Vol. XV, page 455.

  Knowlton, A. D., G. A. Locke and F. J. Singer, Switchboards and Signaling Facilities of the Teletypewriter Exchange System, Vol. XV, page 504.
- Kreer, J. G., L. A. Ware and E. Peterson, Regeneration Theory and Experiment, Vol. XIII, page 680.
- Kress, H. and C. R. Avery, Cellulose Acetate Treatment for Textile Insulation-Development of the Manufacturing Process, Vol. XI, page 231.

- Lack, F. R.; G. W. Willard and 1. E. Fair, Some Improvements in Quartz Crystal Circuit Elements, Vol. XIII, page 453.
- Laird, A. G. and A. G. Ganz, Improvements in Communication Transformers, Vol. XV. page 136.
- Lane, C. E., Crystal Channel Filters for the Cable Carrier System, Vol. XVII, page 125. Laplacian Expansion for Hermitian-Laplace Functions of High Order, A, E. C. Molina, Vol. XV, page 355.
- Laplacian Integrals in Terms of Incomplete Gamma Functions, An Expansion for, and Some Applications, E. C. Molina, Vol. XI, page 563.

  Lattimer, I. E., F. A. Cowan and R. G. McCurdy, Engineering Requirements for Program
- Transmission Circuits, Vol. XX, page 235.
- Lawther, H. P., An Application of Number Theory to the Splicing of Telephone Cables, Vol. XIV, page 273.
- Lawther, H. P. and W. O. Pennell, A Magneto-Elastic Source of Noise in Steel Telephone Wires, Vol. XV, page 334.
- Lead, A Rapid Visual Test for the Quantitative Determination of Small Concentrations of Calcium in, Earle E. Schumacher and G. M. Bouton, Vol. XX, page 434.

Lead-Tin-Arsenic Wiping Solder, Earle E. Schumacher and G. S. Phipps, Vol. XIX, page

d in Air

Future,

Vestern

ations,

uency

I, Vol.

XIV.

Open-

, Vol.

ower

ssion VIII.

2. 11.

1 the

Vol.

lop-

ruit

W.

na,

ım

es.

ne

of

'. E., Survey of Magnetic Materials and Applications in the Telephone System, Vol. XVIII, page 438 Magnetic Measurements at Low Flux Densities Using the Alternating Current Bridge,

Vol. XV, page 39.

Legg, V. E. and W. B. Ellwood, Study of Magnetic Losses at Low Flux Densities in Per-

malloy Sheet, Vol. XVI, page 212.

Legg, V. E. and F. J. Given, Compressed Powdered Molybdenum Permalloy for High

Quality Inductance Coils, Vol. XIX, page 385.

Leibe, F. A., E. I. Green and H. E. Curlis, The Proportioning of Shielded Circuits for Minimum High-Frequency Attenuation, Vol. XV, page 248.

Leutritz, John, R. E. Waterman and Caleb M. Hill, A Laboratory Evaluation of Wood Preservatives, Vol. XVI, page 194.

Levin, S. A. and Liss C. Peterson, An extension of the Theory of Three-Electrode Vacuum

Tube Circuits, Vol. XIII, page 523. Further Extensions of Theory of Multi-Electrode Vacuum Tube Circuits, Vol. XIV, page 666.

Line Problems in the Development of the Twelve-Channel Open-Wire Carrier System, L. M. Ilgenfritz, R. N. Hunter and A. L. Whitman, Vol. XVIII, page 363.

Lines, Open-Wire, A Twelve-Channel Carrier Telephone System for, B. W. Kendall and H. A. Affel Vol. XVIII, page 119.
Lines, Transcontinental Telephone, J. J. Pilliod, Vol. XVIII, page 235.

Little, J. S., Insulation of Telephone Wire with Paper Pulp, Vol. XX, page 82.

Llewellyn, F. B., Constant Frequency Oscillators, Vol. XI, page 67 Vacuum Tube Electronics at Ultra-high Frequencies, Vol. XIII, page 59. Operation of Ultra-High-Frequency Vacuum Tubes, Vol. XIV, page 632. Equivalent Networks of Negative Grid Vacuum Tubes at Ultra-High Frequencies, Vol. XV, page 575.

Llewellyn, F. B. and A. E. Bowen, The Production of Ultra-High-Frequency Oscillations by Means of Diodes, Vol. XVIII, page 280.

Llewellyn, F. B. and J. B. Johnson, Limits to Amplification, Vol. XIV, page 85

Load Rating Theory for Multi-Channel Amplifiers, B. D. Holbrook and J. T. Dixon, Vol. XVIII, page 624.

Loading: Compressed Powdered Molybdenum Permalloy for High Quality Inductance Coils, V. E. Legg and F. J. Given, Vol. XIX, page 385.

Locke, G. A., A. D. Knowlton and F. J. Singer, Switchboards and Signaling Facilities of the Teletypewriter Exchange System, Vol. XV, page 504.

Long Distance Telephone Circuits in Cable, A. B. Clark and H. S. Osborne, Vol. XI,

page 520.

Loud Speakers and Microphones, E. C. Wente and A. L. Thuras, Vol. XIII, page 259. Loudness, Its Definition, Measurement and Calculation, Harvey Fletcher and W. A.

Munson, Vol. XII, page 377.

Lowry, L. R., E. Bruce and A. C. Beck, Horizontal Rhombic Antennas, Vol. XIV, page 135.

Loye, D. P., C. J. Spain and E. W. Templin, Reduction of Airplane Noise and Vibration (a Digest), Vol. XV, page 626.

### M

McCurdy, R. G., F. A. Cowan and I. E. Lattimer, Engineering Requirements for Program Transmission Circuits, Vol. XX, page 235

McKown, F. W. and J. W. Emling, A System of Effective Transmission Data for Rating Telephone Circuits, Vol. XII, page 331.

McLean, D. A., R. L. Peek, Jr. and E. E. Schumacher, Some Physical Properties of Wiping Solders, Vol. XI, page 101.

Magnet Steels and Permant Magnets-Relationships Among their Magnetic Properties, K. L. Scott, Vol. XI, page 383

Magnetic Alloys of Iron, Nickel, and Cobalt, G. W. Elmen, Vol. XV, page 113.

Magnetic Generation of a Group of Harmonics, E. Peterson J. M. Manley and L. R. Wrathall, Vol. XVI, page 437.

Magnetic Losses at Low Flux Densities in Permalloy Sheet, Study of, W. B. Ellwood and V. E. Legg, Vol. XVI, page 212.

Metals,

Microche L

Microph G

Microph

Microph Microph

Microph

Micropl

Mills, 1 Mills, 1

Mitchel

Modula Modul

Modul Modul

Modu

Modu

Moist

Molin

Moly Mont

Moni

Morg

Mor Mot Mo

Mu

Mu

Mu

Mi

M

M

- Magnetic Materials and Applications in the Telephone System, Survey of, V. E. Leve. Vol. XVIII, page 438.
- Magnetic Materials in Relation to Structure, A Survey of, W. C. Ellis and Earle E. Schumacher, Vol. XIV, page 8.
- Magnetic Measurements at Low Flux Densities Using the Alternating Current Bridge.
- Victor E. Legg, Vol. XV, page 39.

  Magnetic Shielding of Transformers at Audio Frequencies, W. G. Gustafson, Vol. XVII.
- Magnetic Tape, Sound Recording on, C. N. Hickman, Vol. XVI, page 165.
- Magnetism, The Theory of—Contemporary Advances in Physics, XXX, Karl K. Darrow, Vol. XV, page 224.
- Magnetism: Ferromagnetic Distortion of a Two-Frequency Wave, Robert M. Kalb and
- William R Bennett, Vol. XIV, page 322.

  Magneto-Elastic Source of Noise in Steel Telephone Wires, A, W. O. Pennell and H. P. Lawther, Vol. XV, page 334.
- Maintenance, Telephone Circuit, New Transmission Measuring Systems for, F. H. Best.
- Vol. XVII, page 1.

  Manley, J. M., E. Peterson and L. R. Wrathall, Magnetic Generation of a Group of Harmonics, Vol. XVI, page 437.
- Marshall, R. N. and F. F. Romanow, A Non-Directional Microphone, Vol. XV, page 405.
- Mason, W. P., Electrical and Mechanical Analogies, Vol. XX, page 405.
  An Electromechanical Representation of a Piezoelectric Crystal (a Digest), Vol. XIV, page 718.
  - Low Temperature Coefficient Quartz Crystals, Vol. XIX, page 74.
  - Resistance Compensated Band-Pass Crystal Filters for Use in Unbalanced Circuits. Vol. XVI, page 423.
- Electrical Wave Filters Employing Quartz Crystals as Elements, Vol. XIII, page 405. Mason, W. P. and R. A. Sykes, Electrical Wave Filters Employing Crystals with Normal and Divided Electrodes, Vol. XIX, page 221.
  - The Use of Coaxial and Balanced Transmission Lines in Filters and Wide-Band
- Transformers for High Radio Frequencies, Vol. XVI, page 275.

  Materials, Magnetic, A Survey of in Relation to Structure, W. C. Ellis and Earle E.
- Schumacher, Vol. XIV, page 8.

  Materials, Metallic, in the Telephone System, Earl E. Schumacher and W. C. Ellis, Vol. XIX, page 138.
- Mathematics, Industrial, Thornton C. Fry, Vol. XX, page 255.
- Mathes, R. C. and S. B. Wright, The Compandor-An Aid Against Static in Radio Te-
- lephony, Vol. XIII, page 315. Mathis, J. D. and L. C. Starbird, Some Applications of the Type "J" Carrier System, Vol. XVIII, page 338.
- Matte, A. L., Advances in Carrier Telegraph Transmission, Vol. XIX, page 161.
- Meacham, L. A., The Bridge Stabilized Oscillator, Vol. XVII, page 574.

  Mead, Sallie P., John R. Carson and S. A. Schelkunoff, Hyper-Frequency Wave Guides—
  Mathematical Theory, Vol. XV, page 310.

  Mead, Sallie Pero and Ray S. Hoyt, Mutual Impedances of Parallel Wires, Vol. XIV, page
- 509
- Meader, R. B. and F: A. Gifford, Marine Radio Telephone Service for Boston Harbor
- (a Digest), Vol. XIV, page 702.

  Measurement of Telegraph Transmission, Recent Developments in the, R. B. Shanck, F. A. Cowan and S. I. Cory, Vol. XVIII, page 143.
- Mertz, Pierre and Frank Gray, A Theory of Scanning and Its Relation to the Characteristics of the Transmitted Signal in Telephotography and Television, Vol. XIII, page 464. Mertz, P. and K. W. Pfleger, Irregularities in Broad-Band Wire Transmission Circuits.
- Vol. XVI, page 541. Metallic Materials in the Telephone System, Earle E. Schumacher and W. C. Ellis, Vol.
- XIX, page 138.
- Metals, Some Theoretical and Practical Aspects of Gases in, J. H. Scaff and E. E. Schumacher, Vol. XII, page 178.
- Metals, The Corrosion of I. Mechanism of Corrosion Processes, R. M. Burns, Vol. XV, page 20.

Metals, Corrosion of-II. Lead and Lead-Alloy Cable Sheathing, R. M. Burns, Vol. XV, page 603.

Microchem cal and Special Methods of Analysis in Communication Research, Beverly L. Clarke and H. W. Hermance, Vol. XV, page 483.

Microphone, The Carbon: An Account of Some Researches Bearing on Its Action, F. S. Goucher, Vol. XIII, page 163.

Microphone, A Non-Directional, R. N. Marshall and F. F. Romanow, Vol. XV, page 405. Microphone System, An Efficient Miniature Condenser, H. C. Harrison and P. B. Flanders, Vol. XI, page 451.

Microphones, Loud Speakers and, E. C. Wente and A. L. Thuras, Vol. XIII, page 259. Microphones, Carbon, and Other Granular Resistances, Spontaneous Resistance Fluctua-

tions in, C. J. Christensen and G. L. Pearson, Vol. XV, page 197

Microphonic Noise in Vacuum Tubes, The Measurement and Reduction of, D. B. Penick, Vol. XIII, page 614.

Mills, R. H., H. A. Affel and R. W. Chesnut, Transmission Lines, Vol. XIII, page 285.
Mills, R. H., H. J. Fisher and M. L. Almquist, A New Single Channel Carrier Telephone System, Vol. XVII, page 162.

Mitchell, D. and S. B. Wright, Two-Way Radio Telephone Circuits, Vol. XI, page 368. Modulation, Cross-, Requirements on Multichannel Amplifiers Below Overload, W. R. Bennett, Vol. XIX, page 587.

Modulation, Frequency: Theory of the Feedback Receiving Circuit, John R. Carson, Vol.

d and

Legg.

Schan

idge,

VII.

row.

and

. P.

Best.

lar 05

ol.

ts.

al

nd

E

1

XVIII, page 395. Modulation Products, New Results in the Calculation of, W. R. Bennett, Vol. XII, page

Modulation Systems, Frequency—The Application of Negative Feedback to, J. G. Chaffee, Vol. XVIII, page 404.

Modulator Circuits, Equivalent, E. Peterson and L. W. Hussey, Vol. XVIII, page 32 Modulators, Copper Oxide, in Carrier Telephone Systems, R. S. Caruthers, Vol. XVIII,

Moisture in Textiles, Albert C. Walker, Vol. XVI, page 228.

Molina, E. C., An Expansion for Laplacian Integrals in Terms of Incomplete Gamma Functions, and Some Applications, Vol. XI, page 563.

A Laplacian Expansion for Hermitian-Laplace Functions of High Order, Vol. XV, page 355.

Molybdenum Permalloy, Compressed Powdered, for High Quality Inductance Coils, V. E. Legg and F. J. Given, Vol. XIX, page 385.

Montgomery, H. C., An Optical Harmonic Analyzer, Vol. XVII, page 406.
Montgomery, H. C., J. C. Steinberg and M. B. Gardner, Results of the World's Fair Hearing Tests, Vol. XIX, page 533.

Morgan, S. O. and E. J. Murphy, The Dielectric Properties of Insulating Materials, I. Vol. XVI, page 493. The Dielectric Properties of Insulating Materials, II. Vol. XVII, page 640. The Dielectric Properties of Insulating Materials, III. Vol. XVIII, page 502.

Morris, R. M., H. A. Chinn and D. K. Gannett, A New Standard Volume Indicator and Reference Level, Vol. XIX, page 94.

Motion Picture Photography, High Speed, W. Herriott, Vol. XVII, page 393.

Moulding: Plastic Materials in Telephone Use, J. R. Townsend and W. J. Clark, Vol. XVIII, page 482.

Multi-Channel Amplifiers, Load Rating Theory for, B. D. Holbrook and J. T. Dixon, Vol. XVIII, page 624.

Multi-Electrode Vacuum Tubes, Theory of, H. A. Pidgeon, Vol. XIV, page 44. Multiplex Systems, Time Division, W. R. Bennett, Vol. XX, page 199.

Mumford, W. W., C. R. Englund and A. B. Crawford, Some Results of a Study of Ultra-Short Wave Transmission Phenomena, Vol. XII, page 197.

Further Results of a Study of Ultra-Short-Wave Transmission Phenomena, Vol. XIV, page 369.

Ultra-Short-Wave Transmission and Atmospheric Irregularities, Vol. XVII, page

Munson, W. A. and Harvey Fletcher, Loudness, Its Definition, Measurement and Calculation, Vol. XII, page 377. Murphy, E. J. and S. O. Morgan, The Dielectric Properties of Insulating Materials, I.

Vol. XVI, page 493.

O'Leary,

O'Neill,

Open-W

Open-W

Operation Optics, Osborne Oscillat

Oscillat

Oscillat

Oscillat

Oscilla

Oscilla

Oscilla

Oscilla

Oscilla

Oscillo

Oscillo

Paint

Paper

Pears

Pears

Peek.

Peni

Penn

Peri Peri

Pete

Pet

Pet

Pet

Pe

P

The Dielectric Properties of Insulating Materials, II. Vol. XVII, page 640. The Dielectric Properties of Insulating Materials, III. Vol. XVIII, page 502.

Murphy, O. J. and A. C. Norwine, Characteristic Time Intervals in Telephonic Conversation, Vol. XVII, page 281.

Musa Receiving System for Commercial Operation on Transatlantic Radio Telephone Circuits, A Single Sideband, F. A. Polkinghorn, Vol. XIX, page 306.

Music, Symphonic, Symposium on Wire Transmission of and Its Reproduction in Auditory Perspective, Vol. XIII, pages 239-301.

Mutual Impedances of Parallel Wires, Ray S. Hoyt and Sallie Pero Mead, Vol. XIV, page

Nance, H. H., Wire Communication Aids to Air Transportation, Vol. XI, page 462.

Network Theorem, A Ladder, John Riodan, Vol. XVI, page 303.

Network, n Terminal, The Number of Impedances of an, John Riordan, Vol. XVIII. page 300.

Networks, Equivalent, of Negative Grid Vacuum Tubes at Ultra-High Frequencies, F. B. Llewellyn, Vol. XV, page 575.

Networks, Constant Resistance, with Applications to Filter Groups, E. L. Norton, Vol. XVI, page 178.

New Telephone Sets, Instruments for the, W. C. Jones, Vol. XVII, page 338

New Telephone Sets, Transmission Features of the, A. H. Inglis, Vol. XVII, page 358. Newhouse, R. C., and Lloyd Espenschied, A Terrain Clearance Indicator, Vol. XVIII. page 222

Noise in Steel Telephone Wires, A Magneto-Elastic Source of, W. O. Pennell and H. P. Lawther, Vol. XV, page 334.

Noise in Vacuum Tubes, Fluctuation, G. L. Pearson, Vol. XIII, page 634.

Noise, Background, The Effect of in Shared Channel Broadcasting, C. B. Aiken, Vol. XIII, page 333.

Noise, the Composite, Resulting from Random Variable Sources, the Computation of E. Dietze and W. D. Goodale, Jr., Vol. XVIII, page 605.

Noise, Microphonic, The Measurement and Reduction of in Vacuum Tubes, D. B. Penick, Vol. XIII, page 614.

Noise, Telephone, and Power Wave Shape, Measurement of (a Digest), J. M. Barstow, P. W. Blye and H. E. Kent, Vol. XV, page 151.

Noise Induction, Some Theoretical and Practical Aspects of, R. F. Davis and H. R. Huntley, Vol. XII, page 469.

Noise Reduction, Radio Telephone, by Voice Control at Receiver, C. C. Taylor, Vol. XVI, page 475

Noise and Vibration, Airplane, Reduction of (a Digest), C. J. Spain, D. P. Loye and E. W. Templin, Vol. XV, page 626.

Norton, E. L., Constant Resistance Networks with Applications to Filter Groups, Vol. XVI, page 178.

Norwine, A. C., Devices for Controlling Amplitude Characteristics of Telephonic Signals,

Vol. XVII, page 539.

Norwine, A. C. and O. J. Murphy, Characteristic Time Intervals in Telephonic Conver-

sation, Vol. XVII, page 281. Nuclear Fission, Karl K. Darrow, Vol. XIX, page 267. Nyquist, H., Regeneration Theory, Vol. XI, page 126.

Nyquist, H. and K. W. Pfleger, Effect of the Quadrature Component in Single Sideband Transmission, Vol. XIX, page 63.

O'Connell, E. J. and H. R. Huntley, Some Aspects of Low-Frequency Induction between Power and Telephone Circuits, Vol. XIV, page 573.

Odarenko, T. M. and R. P. Booth, Crosstalk between Coaxial Conductors in Cable, Vol. XIX, page 358.

Odarenko, T. M. and S. A. Schelkunoff, Crosstalk between Coaxial Transmission Lines,

Vol. XVI, page 144.

O'Leary, J. T., E. C. Blessing and J. W. Beyer, An Improved Three-Channel Carrier Telephone System, Vol. XVIII, page 49.

O'Neill, H. T., A. L. Thuras and R. T. Jenkins, Extraneous Frequencies Generated in Air Carrying Intense Sound Waves, Vol. XIV, page 159.

Open-Wire Carrier System, Twelve-Channel, Line Problems in the Development of the, L. M. Ilgenfritz, R. N. Hunter and A. L. Whitman, Vol. XVIII, page 363. Open-Wire Lines, A Twelve-Channel Carrier Telephone System for, B. W. Kendall and H. A. Affel, Vol. XVIII, page 119.

nver

hone

itory

III.

. B.

11.

P

if.

Operational Calculus, An Extension of, John R. Carson, Vol. XV, page 340.

Optics, Electrostatic Electron, Frank Gray, Vol. XVIII, page 1.

Osborne, H. S. and A. B. Clark, Long Distance Telephone Circuits in Cable, Vol. XI, page 520.

Oscillations in an Electromechanical System, L. W. Hussey and L. R. Wrathall, Vol. XV, page 441.

Oscillations in Systems with Non-Linear Reactance, R. V. L. Hartley, Vol. XV, page 424. Oscillations, Ultra-High-Frequency, The Production of by Means of Diodes, F. B. Llew-ellyn and A. E. Bowen, Vol. XVIII, page 280. Oscillator, The Bridge Stabilized, L. A. Meacham, Vol. XVII, page 574.

Oscillator and Amplifier, A Negative Grid Triode, for Ultra-High Frequencies (a Digest),
A. L. Samuel, Vol. XVI, page 568.

Oscillators, Stabilized Feedback, G. H. Stevenson, Vol. XVII, page 458 Oscillators, Constant Frequency, F. B. Llewellyn, Vol. XI, page 67.

Oscillators, High Accuracy Heterodyne, T. Slonczewski, Vol. XIX, page 407.

Oscillators, High-Frequency, Vacuum Tubes as, M. J. Kelly and A. L. Samuel, Vol. XIV, page 97.

Oscillograph for Ten Thousand Cycles, An, A. M. Curtis, Vol. XII, page 76. Oscillograph, The Cathode Ray, J. B. Johnson, Vol. XI, page 1.

Paints, Determination of the Corrosion Behavior of Painted Iron and the Inhibitive Action

of (a Digest), R. M. Burns and H. E. Haring, Vol. XV, page 343.

Paper Pulp, Insulation of Telephone Wire with, J. S. Little, Vol. XX, page 82.

Pearson, G. L., Fluctuation Noise in Vacuum Tubes, Vol. XIII, page 634.

Pearson, G. L. and C. J. Christensen, Spontaneous Resistance Fluctuations in Carbon Microphones and Other Granular Resistances, Vol. XV, page 197.

Peek, R. L., Jr., E. E. Schumacher and D. A. McLean, Some Physical Properties of Wiping Solders, Vol. XI, page 101.

Penick, D. B., The Measurement and Reduction of Microphonic Noise in Vacuum Tubes, Vol. XIII, page 614.

Pennell, W. O. and H. P. Lawther, A Magneto-Elastic Source of Noise in Steel Telephone

Wires, Vol. XV, page 334.

Permalloy, Compressed Powdered Molybdenum, for High Quality Inductance Coils, V. E. Legg and F. J. Given, Vol. XIX, page 385.

Permalloy Sheet, Study of Magnetic Losses at Low Flux Densities in, W. B. Ellwood and

V. E. Legg, Vol. XVI, page 212.

Peterson, A. C. and R. K. Potter, The Reliability of Short-Wave Radio Telephone Circuits, Vol. XV, page 181.

Peterson, E. and L. W. Hussey, Equivalent Modulator Circuits, Vol. XVIII, page 32. Peterson, E., J. G. Kreer and L. A. Ware, Regeneration Theory and Experiment, Vol. XIII, page 680.

Peterson, E., J. M. Manley and L. R. Wrathall, Magnetic Generation of a Group of Har-

monics, Vol. XVI, page 437.

Peterson, Liss C., Impedance Properties of Electron Streams, Vol. XVIII, page 465.

Peterson, Liss C. and S. A. Levin, An Extension of the Theory of Three-Electrode Vacuum Tube Circuits, Vol. XIII, page 523. Further Extensions of Theory of Multi-Electrode Vacuum Tube Circuits, Vol-

XIV, page 666.

Pfleger, K. W. and P. Mertz, Irregularities in Broad-Band Wire Transmission Circuits, Vol. XVI, page 541.

Pfleger, K. W. and H. Nyquist, Effect of the Quadrature Component in Single Sideband Transmission, Vol. XIX, page 63.

Phipps, G. S., H. E. Haring, U. B. Thomas and E. E. Schumacher, Superiorities of Lead-Calcium Alloys for Storage Battery Construction (a Digest), Vol. XIV, page 100 Phipps, G. S. and Earle E. Schumacher, Lead-Tin-Arsenic Wiping Solder, Vol. XIX, page 262.

Ouantu

Quarles

Quartz

Quartz

Rack,

Radia Radio

Radio Radio

Radio

Radi

Radi Radi

Radi

Rad

Rad

Rad

Rad

Rac

Rac

Ra

Ra

Ra

Ra

Ra

R R

R

R

Photoelectric Cell, The Caesium-Oxygen-Silver, C. H. Prescott, Jr. and M. J. Kelly, Vol. XI, page 334.

Physical Factors (of Wire Transmission of Symphonic Music and Its Reproduction in Auditory Perspective), J. C. Steinberg and W. B. Snow, Vol. XIII, page 245.
Physical Properties of Wiping Solders, Some, D. A. McLean, R. L. Peek, Jr., and E. E.

Schumacher, Vol. XI, page 101. Physics, The Quantum, of Solids, I-The Energies of Electrons in Crystals, W. Shockley

Vol. XVIII, page 645.

Physics, Contemporary Advances in, Karl K. Darrow:

XXIII. Data and Nature of Cosmic Rays, Vol. XI, page 148.

XXIV. High-Frequency Phenomena in Gases, First Part, Vol. XI, page 576. XXV. High-Frequency Phenomena in Gases, Second Part, Vol. XII, page 91 XXVI. The Nucleus, First Part, Vol. XII, page 288.

XXVII. The Nucleus, Second Part, Vol. XIII, page 102.

XXVIII. The Nucleus, Second Part, Vol. XIII, page 102.

XXVIII. The Nucleus, Third Part, Vol. XIII, pages 391 and 580.

XXIX. The Nucleus, Fourth Part, Vol. XIV, page 285.

XXX. The Theory of Magnetism, Vol. XV, page 224.

XXXI. Spinning Atoms and Spinning Electrons, Vol. XVI, page 319.

XXXII. Particles of the Cosmic Rays, Vol. XVIII, page 190. Forces and Atoms: The World of the Physicist, Vol. XX, page 340.

Nuclear Fission, Vol. XIX, page 267. Analysis of the Ionosphere, Vol. XIX, page 455

Radioactivity—Artificial and Natural, Vol. XVII, page 292.

Pidgeon, H. A., Theory of Multi-Electrode Vacuum Tubes, Vol. XIV, page 44.
Pierce, R. E. and E. W. Bemis, A Transmission System for Teletypewriter Exchange Serv ice, Vol. XV, page 529.

Piezoelectric Crystal, An Electromechanical Representation of a (a Digest), W. P. Mason. Vol. XIV, page 718.

Pilliod, J. J., Transcontinental Telephone Lines, Vol. XVIII, page 235.
Plastic Materials in Telephone Use, J. R. Townsend and W. J. Clarke, Vol. XVIII, page 482.

Polkinghorn, F. A., A Single Sideband Musa Receiving System for Commercial Operation

on Transatlantic Radio Telephone Circuits, Vol. XIX, page 306.

Polkinghorn, F. A. and N. F. Schlaack, An Unattended Ultra-Short-Wave Radio Telephone System (a Digest), Vol. XIV, page 534.

A Single-Sideband Short-Wave System for Transatlantic Telephony, Vol. XIV,

page 489. Poles, Creosoted Southern Pine, The Relation between Penetration and Decay in,  $R.\ H.$ Colley and C. H. Amadon, Vol. XV, page 363.

Potter, R. K. and A. C. Peterson, Jr., The Reliability of Short-Wave Radio Telephone Circuits, Vol. XV, page 181.

Power Distribution Systems, Common-Neutral, and Telephone Circuits, The Inductive Coordination of, J. O'R. Coleman and R. F. Davis, Vol. XVI, page 76.

Power Systems, Three-Phase, A Solution for Faults at Two Locations in, E. F. Vaage, Vol. XIX, page 290.

Prescott, C. H., Jr. and M. J. Kelly, The Caesium-Oxygen-Silver Photoelectric Cell, Vol. XI, page 334. Probability Theory and Telephone Transmission Engineering, Ray S. Hoyt, Vol. XII,

Program Transmission Circuits, Engineering Requirements for, F. A. Cowan, R. G. Mc-Curdy and I. E. Lattimer, Vol. XX, page 235.
 Propagation, Radio, Over Spherical Earth, Chas. R. Burrows, Vol. XIV, page 477.

Propagation, Ultra-Short-Wave: Mobile Urban Transmission Characteristics, C. R.

Burrows, L. E. Hunt and A. Decino, Vol. XIV, page 253. Puget Sound Area, Harbor Craft Ship-to-Shore Radio Telephone Service in (a Digest), E. B. Hansen, Vol. XIV, page 708.

Pulp Insulation for Telephone Cables, H. G. Walker and L. S. Ford, Vol. XII, page 1.

- Quantum Physics, The, of Solids, I-The Energies of Electrons in Crystals, W. Shockley, Vol. XVIII, page 645.
- Quarles, D. A., A New Type of Underground Telephone Wire, Vol. XV, page 446.
- Quartz Crystal Circuit Elements, Some Improvements in, F. R. Lack, G. W. Willard and I. E. Fair, Vol. XIII, page 453.
- Quartz Crystals in Elements, Electrical Wave Filters Employing, W. P. Mason, Vol. XIII, page 405.

# R

- Rack, A. J., Effect of Space Charge and Transit Time on the Shot Noise in Diodes, Vol. XVII, page 592.
- Radiation Problems, Some Equivalence Theorems of Electromagnetics and their Applica-tion to, S. A. Schelkunoff, Vol. XV, page 92.
- Radioactivity-Artificial and Natural, Karl K. Darrow, Vol. XVII, page 292.

Load. te 600

, lage

V. Vol.

ion in

E.E. ockley

91

TV

on

ige

on ne

V. 7.

10

e

8,

- Radio Extension Links to the Telephone System, R. A. Heising, Vol. XIX, page 611.
- Radio Frequencies, High, The Use of Coaxial and Balanced Transmission Lines in Filters and Wide-Band Transformers for, W. P. Mason and R. A. Sykes, Vol. XVI, page 275.
- Radio Propagation over Plane Earth-Field Strength Curves, Charles R. Burrows, Vol. XVI, page 45; Addendum to, page 574.
- Radio Propagation over Spherical Earth, Chas. R. Burrows, Vol. XIV, page 477.
- Radio Systems, Short-Wave, Transmission Lines for, E. J. Sterba and C. B. Feldman, Vol. XI, page 411.
- Radio Telephone Circuits, Short-Wave, The Reliability of, R. K. Potter and A. C. Peterson, Jr., Vol. XV, page 181.
- Radio Telephone Circuits, Transatlantic, A Single Sideband Musa Receiving System for Commercial Operation on, F. A. Polkinghorn, Vol. XIX, page 306.
- Radio Telephone Circuits, Two-Way, S. B. Wright and D. Mitchell, Vol. XI, page 368.
- Radio Telephone Development, Transoceanic (a Digest), Ralph Bown, Vol. XVI, page 560. Radio Telephone Noise Reduction by Voice Control at Receiver, C. C. Taylor, Vol. XVI,
- page 475. Radio Telephone Service for Boston Harbor, Marine (a Digest), F. A. Gifford and R. B.
- Meader, Vol. XIV, page 702.

  Radio Telephone Service in Puget Sound Area, Harbor Craft Ship-to-Shore (a Digest), E. B. Hansen, Vol. XIV, page 708.
- Radio Telephone System, An Unattended Ultra-Short-Wave (a Digest), N. F. Schlaack and F. A. Polkinghorn, Vol. XIV, page 534.
  Radio Telephony, The Compandor—An Aid Against Static in, R. C. Mathes and S. B.
- Wright, Vol. XIII, page 315.
- Radio Transmission Phenomena Associated with a Cessation of the Sun's Rays, Long-
- Wave, Austin Bailey and A. E. Harper, Vol. XV, page 1.
  Radio Transmission with Solar Phenomena On the Correlation of (a Digest), A. M. Skellett, Vol. XV, page 157.
- Radio: A New High-Efficiency Power Amplifier for Modulated Waves, W. H. Doherty,
- Vol. XV, page 469. Radio: A Power Amplifier for Ultra-High Frequencies, A. L. Samuel and N. E. Sowers, Vol. XVI, page 10.
- Radio: A Multiple Unit Steerable Antenna for Short-Wave Reception, H. T. Friis and C. B. Feldman, Vol. XVI, page 337.
- Radio: Horizontal Rhombic Antennas, E. Bruce, A. C. Beck and L. R. Loury, Vol. XIV, page 135
- Radio: Audio Frequency Atmospherics, E. T. Burton and E. M. Boardman, Vol. XII, page 498.
- Radio: Series for the Wave Function of a Radiating Dipole at the Earth's Surface, S. O.
- Rice, Vol. XVI, page 101.
  Radio: The History of Electrical Resonance, Julian Blanchard, Vol. XX, page 415.
- Radio: Engineering Requirements for Program Transmission Circuits, F. A. Cowan, R. G. McCurdy and I. E. Lattimer, Vol. XX, page 235.

Radio: Experiments with Directivity Steering for Fading Reduction, E. Bruce and A. C. Beck, Vol. XIV, page 195.

Radio: Line Filter for Program System, A. W. Clement, Vol. XIII, page 382

Radio: Hertz, the Discoverer of Electric Waves, Julian Blanchard, Vol. XVII, page 327. Radio: Analysis of the Ionosphere, Karl K. Darrow, Vol. XIX, page 455.

Radio: Eclipse Effects in the Ionosphere, J. P. Schafer and W. M. Goodall, Vol. XV, page

Radio: The Effect of Background Noise in Shared Channel Broadcasting, C. B. Aiken, Vol. XIII, page 333

Radio: A Negative Grid Triode Oscillator and Amplifier for Ultra-High Frequencies (a Digest), A. L. Samuel, Vol. XVI, page 568.

Radio: Transatlantic Long-Wave Transmission, Austin Bailey and H. M. Thomson, Vol. XIV, page 680.

Radio: Ultra-Short Wave Propagation, J. C. Schelleng, C. R. Burrows and E. B. Ferrell, Vol. XII, page 125.

Radio: Ultra-Short-Wave Propagation: Mobile Urban Transmission Characteristics, C. R. Burrows, L. E. Hunt and A. Decino, Vol. XIV, page 253.

Radio: Some Results of a Study of Ultra-Short Wave Transmission Phenomena, C. R. Englund, A. B. Crawford and W. W. Mumford, Vol. XII, page 197

Radio: Further Results of a Study of Ultra-Short-Wave Transmission Phenomena, C. R. Englund, A. B. Crawford and W. W. Mumford, Vol. XIV, page 369.
Radio: Ultra-Short-Wave Transmission and Atmospheric Irregularities, C. R. Englund,

A. B. Crawford and W. W. Mumford, Vol. XVII, page 489.

Radio: A Single-Sideband Short-Wave System for Transatlantic Telephony, F. A. Polking-horn and N. F. Schlaack, Vol. XIV, page 489. Radio: Effect of the Quadrature Component in Single Sideband Transmission, H. Nyquist

and K. W. Pfleger, Vol. XIX, page 63. Radio: A Representation of the Sunspot Cycle, C. N. Anderson, Vol. XVIII, page 292.

Radio: Equivalent Networks of Negative Grid Vacuum Tubes at Ultra-High Frequencies, F. B. Llewellyn, Vol. XV, page 57. Radio: The Vodas, S. B. Wright, Vol. XVI, page 456.

Radio: A New Standard Volume Indicator and Reference Level, H. A. Chinn, D. K. Gannett and R. M. Morris, Vol. XIX, page 94. Radio: Wide-Band Open-Wire Program System, H. S. Hamilton, Vol. XIII, page 351.

Radio: World-Wide Telephony-Its Problems and Future, B. Gherardi and F. B. Jewett. Vol. XI, page 485

Radio: Around the World by Telephone, Vol. XIV, page 542.

Radio: The Physical Reality of Zenneck's Surface Wave, W. Howard Wise, Vol. XVI, page 35.

Ransom, G. B., W. B. Bedell and W. A. Stevens, Experience in Applying Carrier Telephone Systems to Toll Cables, Vol. XVIII, page 547.

Receiver, Scientific Research Applied to the Telephone Transmitter and, Edwin II. Colpitts, Vol. XVI, page 251

Reduction of Airplane Noise and Vibration (a Digest), C. J. Spain, D. P. Loye and E. W. Templin, Vol. XV, page 626.

Reference Level, A New Standard Volume Indicator and, H. A. Chinn, D. K. Gannett and R. M. Morris, Vol. XIX, page 94.

Regeneration Theory, H. Nyquist, Vol. XI, page 126.

Regeneration Theory and Experiment, E. Peterson, J. G. Kreer, and L. A. Ware, Vol. XIII, page 680

Research, Communication, Spectrochemical Analysis in, Beverly L. Clarke and A. E. Ruehle, Vol. XVII, page 381.

Research, Scientific, Applied to the Telephone Transmitter and Receiver, Edwin H. Colpitts, Vol. XVI, page 251.

Resistivity, Earth, and Geological Structure (a Digest), R. H. Card, Vol. XV, page 167. Resonance, Electrical, The History of, Julian Blanchard, Vol. XX, page 415.

Reynolds, F. W., A New Telephotograph System, Vol. XV, page 549.

Reynolds, J. N. and F. J. Scudder, Crossbar Dial Telephone Switching System, Vol. XVIII, page 76.

Rhombic Antennas, Horizontal, E. Bruce, A. C. Beck and L. R. Lowry, Vol. XIV, page 135. Rice, S. O., Series for the Wave Function of a Radiating Dipole at the Earth's Surface, Vol. XVI, page 101.

Steady State Solutions of Transmission Line Equations, Vol. XX, page 131.

Riordan, . pag A La Riordan, zol

Romanow Romig, H Ruehle, A

Samplin Samuel.

Samuel. Samuel.

> Samuel. Scaff, J

Schafer

Schelkt So

> Schelk Schelk

T

Schell Schla

> Schu Schu

Schi Schi

Sch Sch

Seo

Ser Sci

Sh

Riordan, John, The Number of Impedances of an n Terminal Network, Vol. XVIII, page 300.

A Ladder Network Theorem, Vol. XVI, page 303.

Riordan, John and Erling D. Sunde, Mutual Impedance of Grounded Wires for Horizontally Stratified Two-Layer Earth, Vol. XII, page 162.

Romanow, F. F. and R. N. Marshall, A Non-Directional Microphone, Vol. XV, page 405.
Romig, H. G. and H. F. Dødge, Single Sampling and Double Sampling Inspection Tables,
Vol. XX, page 1.

Ruehle, A. E. and Beverly L. Clarke, Spectrochemical Analysis in Communication Research, Vol. XVII, page 381.

327

R

R

d,

g.

## 9

Sampling Inspection Tables, Single Sampling and Double, H. F. Dodge and H. G. Romig\* Vol. XX, page 1.

Samuel, A. L., A Negative Grid Triode Oscillator and Amplifier for Ultra-High Frequencies (a Digest), Vol. XVI, page 568.

Samuel, A. L., C. E. Fay and W. Shockley, On the Theory of Space Charge between Parallel Plane Electrodes, Vol. XVII, page 49.

Samuel, A. L. and M. J. Kelly, Vacuum Tubes as High-Frequency Oscillators, Vol. XIV, page 97.

Samuel, A. L. and N. E. Sowers, A Power Amplifier for Ultra-High Frequencies, Vol. XVI, page 10.

Scaff, J. H. and E. E. Schumacher, Some Theoretical and Practical Aspects of Gases in Metals, Vol. XII, page 178.

Schafer J. P. and W. M. Goodall, Eclipse Effects in the Ionosphere (a Digest), Vol. XV, page 162.

Schelkunoff, S. A., The Electromagnetic Theory of Coaxial Transmission Lines and Cylindrical Shields, Vol. XIII, page 532.
Some Equivalence Theorems of Electromagnetics and their Application to Radiation

Problems, Vol. XV, page 92.

The Impedance Concept and its Application to Problems of Reflection, Refraction, Shielding and Power Absorption, Vol. XVII, page 17.

Schelkunoff, S. A., John R. Carson and Sallie P. Mead, Hyper-Frequency Wave Guides—

chelkunoff, S. A., John R. Carson and Sallie P. Mead, Hyper-Frequency Wave Guides— Mathematical Theory, Vol. XV, page 310.

Schelkunoff, S. A. and T. M. Odarenko, Crosstalk between Coaxial Transmission Lines, Vol. XVI, page 144.
Schelleng, J. C., C. R. Burrows and E. B. Ferrell, Ultra-Short Wave Propagation, Vol.

XII, page 125.

Schlaack, N. F. and F. A. Polkinghorn, A Single-Sideband Short-Wave System for Transatlantic Telephony, Vol. XIV, page 489.
An Unattended Ultra-Short-Wave Radio Telephone System (a Digest), Vol. XIV,

page 534.

Schumacher, Earle E. and G. M. Bouton, A Rapid Visual Test for the Quantitative Determination of Small Concentrations of Calcium in Lead, Vol. XX, page 434.

Schumacher, Earle E. and W. C. Ellis, A Survey of Magnetic Materials in Relation to

Structure, Vol. XIV, page 8.

Metallic Materials in the Telephone System, Vol. XIX, page 138.

Schumacher, E. E., H. E. Haring, Č. B. Thomas and G. S. Phipps, Superiorities of Lead-Calcium Alloys for Storage Battery Construction (a Digest), Vol. XIV, page 699, Schumacher, E. E., R. L. Peek, Jr. and D. A. McLean, Some Physical Properties of Wiping Solders, Vol. XI, page 101.

Schumacher, Earle E. and G. S. Phipps, Lead-Tin-Arsenic Wiping Solder, Vol. XIX,

page 262.
Schumacher, E. E. and J. H. Scaff, Some Theoretical and Practical Aspects of Gases in Metals, Vol. XII, page 178.

Scott, K. L., Magnet Steels and Permanent Magnets—Relationships among their Magnetic Properties, Vol. XI, page 383.

Scriven, E. O., Amplifiers, Vol. XIII, page 278.

Scudder, F. J. and J. N. Reynolds, Crossbar Dial Telephone Switching System, Vol. XVIII, page 76.

Shanck, R. B., F. A. Cowan and S. I. Cory, Recent Developments in the Measurement of Telegraph Transmission, Vol. XVIII, page 143. Shaw, L. I. and A. G. Johnson, Some Ceramic Manufacturing Developments of the Western Electric Company, Vol. XVIII, page 255.

Space C

Space C

Spain, ( Spectro

Speech,

Spence,

Splicing

Spring

Stansel

Starbir

Steady

Steady

Steinbe Steinb

Sterba Steven

Steven

Stora

Stork.

Striel

Strie

Strie Strue

Suno

Sun

Sun

Sun Swi

Swi

Swi

Syk

Ta

- Shielded Circuits for Minimum High-Frequency Attenuation, The Proportioning of
- E. I. Green, F. A. Leibe and H. E. Curlis, Vol. XV, page 248.

  Ship-to-Shore Radio Telephone Service in Puget Sound Area, Harbor Craft (a Digest),
  E. B. Hansen, Vol. XIV, page 708.

  Ship-to-Shore Service, Harbor, Ship Sets for (a Digest), H. N. Willets, Vol. XIV, page 713.
- Shock, Electric, on the Heart, Effect of (a Digest), L. P. Ferris, B. G. King, P. W. Spence and H. B. Williams, Vol. XV, page 455.
- Shockley, W., The Quantum Physics of Solids, I-The Energies of Electrons in Crystals, Vol. XVIII, page 645.
- Shockley, W., C. E. Fay and A. L. Samuel, On the Theory of Space Charge between Parallel Plane Electrodes, Vol. XVII, page 49.
- Short-Wave Propagation, Ultra: Mobile Urban Transmission Characteristics, C. R. Burrows, L. E. Hunt and A. Decino, Vol. XIV, page 253.
- Short-Wave Reception, A Multiple Unit Steerable Antenna for, H. T. Friis and C. B. Feldman, Vol. XVI, page 337.
- Short-Wave Radio Telephone Circuits, The Reliability of, R. K. Potter and A. C. Peterson, Jr., Vol. XV, page 181.
- Short-Wave System, A Single-Sideband, for Transatlantic Telephony, F. A. Polkinghorn
- and N. F. Schlaack, Vol. XIV, page 489.

  Short-Wave, Ultra-, Radio Telephone System, An Unattended (a Digest), N. F. Schlaack and F. A. Polkinghorn, Vol. XIV, page 534.
- Short-Wave, Ultra-, Transmission and Atmospheric Irregularities, C. R. Englund, A. B.
- Crawford and W. W. Mumford, Vol. XVII, page 489.

  Short-Wave Transmission Phenomena, Ultra, Further Results of a Study of, C. R. Englund, A. B. Crawford and W. W. Mumford, Vol. XIV, page 369.

  Short Waves: Ultra-Short Wave Propagation, J. C. Schelleng, C. R. Burrows and E. B.
- Ferrell, Vol. XII, page 125.
- Short Waves: Some Results of a Study of Ultra-Short Wave Transmission Phenomena, C. R. Englund, A. B. Crawford and W. W. Mumford, Vol. XII, page 197
- Shot Noise in Diodes, Effect of Space Charge and Transit Time on the, A. J. Rack, Vol.
- XVII, page 592. Sideband Musa Receiving System, A Single, for Commercial Operation on Transatlantic Radio Telephone Circuits, F. A. Polkinghorn, Vol. XIX, page 306.
- Sideband Transmission, Single, Effect of the Quadrature Component in, H. Nyquist and K. W. Pfleger, Vol. XIX, page 63.
- inger, F. J., A. D. Knowlton and G. A. Locke, Switchboards and Signaling Facilities of the Teletypewriter Exchange System, Vol. XV, page 504.
- Singing on Two-Wire Cable Circuits, Circulating Currents and, L. G. Abraham, Vol. XIV, page 600
- Single-Sideband Short-Wave System for Transatlantic Telephony, F. A. Polkinghorn and
- N. F. Schlaack, Vol. XIV, page 489.
  Skellett, A. M., The Coronaviser, an Instrument for Observing the Solar Corona in Full Sunlight, Vol. XIX, page 249.
- On the Correlation of Radio Transmission with Solar Phenomena (a Digest), Vol. XV, page 157.
  Slonczewski, T., High Accuracy Heterodyne Oscillators, Vol. XIX, page 407.
- Snow, W. B. and J. C. Steinberg, Physical Factors (of Wire Transmission of Symphonic Music and Its Reproduction in Auditory Perspective), Vol. XIII, page 245.
- Solar Phenomena, On the Correlation of Radio Transmission with (a Digest), A. M. Skellett, Vol. XV, page 157.
- Solder, Wiping, Lead-Tin-Arsenic, Earle E. Schumacher and G. S. Phipps, Vol. XIX, page 262.
- Solders, Wiping, Some Physical Properties of, D. A. McLean, R. L. Peek, Jr. and E. E. Schumacher, Vol. XI, page 101.
- Sound Recording on Magnetic Tape, C. N. Hickman, Vol. XVI, page 165. Sound Waves, Intense, Extraneous Frequencies Generated in Air Carrying, A. L. Thuras,
- R. T. Jenkins and H. T. O'Neil, Vol. XIV, page 159. Southworth, G. C., Hyper-Frequency Wave Guides—General Considerations and Experimental Results, Vol. XV, page 284.
  Sowers, N. E. and A. L. Samuel, A Power Amplifier for Ultra-High Frequencies, Vol. XVI,
- page 10.

Space Charge between Parallel Plane Electrodes, On the Theory of, C. E. Fay, A. L. Samuel and W. Shockley, Vol. XVII, page 49.

Space Charge and Transit Time on the Shot Noise in Diodes, Effect of, A. J. Rack, Vol.

XVII, page 592.

Spain, C. J., D. P. Loye and E. W. Templin, Reduction of Airplane Noise and Vibration
(a Digest), Vol. XV, page 626.

Spectrochemical Analysis in Communication Research, Beverly L. Clarke and A. E. Ruehle, Vol. XVII, page 381.

Speech, The Carrier Nature of, Homer Dudley, Vol. XIX, page 495.
Spence, P. W., L. P. Ferris, B. G. King and H. B. Williams, Effect of Electric Shock on the Heart (a Digest), Vol. XV, page 455.

Splicing of Telephone Cables, An Application of Number Theory to the, H. P. Lawther, Jr., Vol. XIV, page 273.

Spring Type, Dial Clutch of the, C. F. Wiebusch, Vol. XVIII, page 724.

Stansel, F. R., Some Analyses of Wave Shapes Used in Harmonic Producers, Vol. XX, page 331.

Starbird, L. C. and J. D. Mathis, Some Applications of the Type "J" Carrier System, Vol. XVIII, page 338

Steady State Delay as Related to Aperiodic Signals, R. V. L. Hartley, Vol. XX, page 222. Steady State Solutions of Transmission Line Equations, S. O. Rice, Vol. XX, page 131.

Steinberg, J. C., H. C. Montgomery and M. B. Gardner, Results of the World's Fair Hearing Tests, Vol. XIX, page 533.

Steinberg, J. C. and W. B. Snow, Physical Factors (of Wire Transmission of Symphonic Music and Its Reproduction in Auditory Perspective), Vol. XIII, page 245. Sterba, E. J. and C. B. Feldman, Transmission Lines for Short-Wave Radio Systems, Vol.

XI, page 411.
Stevens, W. A., W. B. Bedell and G. B. Ransom, Experience in Applying Carrier Telephone Systems to Toll Cables, Vol. XVIII, page 547

Stevenson, G. H., Stabilized Feedback Oscillators, Vol. XVII, page 458.

Storage Battery Construction, Superiorities of Lead-Calcium Alloys for (a Digest), H. E. Haring, U. B. Thomas, E. E. Schumacher and G. S. Phipps, Vol. XIV, page 699. Storks, K. H. and L. H. Germer, An Interesting Application of Electron Diffraction (a

es em

ig of.

gest), e 713

pence

stals.

rallel

. R.

. B.

rson,

horn

aack . B.

und,

. B.

ma,

Vol.

itic

ind

the

V, nd

uli

ol.

ic

1.

Č,

9

Digest), Vol. XIX, page 152.

Strieby, M. E., Coaxial Cable System for Television Transmission, Vol. XVII, page 438. A Million-Cycle Telephone System, Vol. XVI, page 1.

Strieby, M. E. and L. Espenschied, Systems for Wide-Band Transmission over Coaxial Lines, Vol. XIII, page 654.

Strieby, M. É. and J. F. Wentz, Television Transmission over Wire Lines, Vol. XX, page 62. Structure, A Survey of Magnetic Materials in Relation to, W. C. Ellis and Earle E. Schumacher, Vol. XIV, page 8.

Sunde, E. D., Currents and Potentials along Leaky Ground-Return Conductors (a Digest),

Vol. XVI, page 110. Sunde, Erling D. and John Riordan, Mutual Impedance of Grounded Wires for Horizontally Stratified Two-Layer Earth, Vol. XII, page 162.

Sun's Rays, Long-Wave Radio Transmission Phenomena Associated with a Cessation of

the, Austin Bailey and A. E. Harper, Vol. XV, page 1.
Sunspot Cycle, A Representation of the, C. N. Anderson, Vol. XVIII, page 292.
Switchboards and Signaling Facilities of the Teletypewriter Exchange System, A. D. Knowlton, G. A. Locke and F. J. Singer, Vol. XV, page 504.

Switching Circuits, Telephone, Contact Phenomena in, A. M. Curtis, Vol. XIX, page 40. Switching System, Crossbar Dial Telephone, F. J. Scudder and J. N. Reynolds, Vol. XVIII,

Sykes, R. A. and W. P. Mason, The Use of Coaxial and Balanced Transmission Lines in Filters and Wide-Band Transformers for High Radio Frequencies, Vol. XVI, page 275

Electrical Wave Filters Employing Crystals with Normal and Divided Electrodes, Vol. XIX, page 221.

Tandem Operation in the Bell System, F. M. Bronson, Vol. XV, page 380. Taylor, C. C., Radio Telephone Noise Reduction by Voice Control at Receiver, Vol. XVI, page 475.

Telegraph Transmission, Recent Developments in the Measurement of, R. B. Shanek,

Transcon

Transform

Transfor

Transmi

Transmi

Transm

Transm

Transn

Transn

Transr

Transo Tubes

Tucker

Ultra

Ultra

Ultra

Ultra

Ultra

Ultra

Und

Vaa

Vac Vac

Vac

Va

Va

Va Va

X Transform

pa

Da Transmis

pa Transmi p

(1 Transm Transm Transm

- F. A. Cowan and S. I. Cory, Vol. XVIII, page 143.
  Telegraph Transmission, Carrier, Advances in, A. L. Matte, Vol. XIX, page 161.
- Telephone, Around the World by, Vol. XIV, page 542. Telephone Circuits, The Inductive Coordination of Common-Neutral Power Distribution
- Systems and, J. O'R. Coleman and R. F. Davis, Vol. XVI, page 76. Telephone Lines, Transcontinental, J. J. Pilliod, Vol. XVIII, page 235.
- Telephone System, An Improved Three-Channel Carrier, J. T. O'Leary, E. C. Blessing and J. W. Beyer, Vol. XVIII, page 49.
- Telephone System for Open-Wire Lines, A Twelve-Channel Carrier, B. W. Kendall and H. A. Affel, Vol. XVIII, page 119.
- Telephonic Signals, Devices for Controlling Amplitude Characteristics of, A. C. Norwine, Vol. XVII, page 539.
- Telephony, Transatlantic, A Single-Sideband Short-Wave System for, F. A. Polkinghorn and N. F. Schlaack, Vol. XIV, page 489.
  Telephotograph System, A New, F. W. Reynolds, Vol. XV, page 549.
- Telephotography and Television, A Theory of Scanning and Its Relation to the Characteristics of the Transmitted Signal in, Pierre Mertz and Frank Gray, Vol. XIII, page 464
- Teletypewriter Exchange Service, A Transmission System for, R. E. Pierce and E. W. Bemis, Vol. XV, page 529.
- Teletypewriter Exchange System, Switchboards and Signaling Facilities of the, A. D. Knowlton, G. A. Locke and F. J. Singer, Vol. XV, page 504.
- Teletypewriters Used in the Bell System, Fundamentals of, E. F. Watson, Vol. XVII, page 620.
- Television, A Theory of Scanning and Its Relation to the Characteristics of the Transmitted Signal in Telephotography and, Pierre Mertz and Frank Gray, Vol. XIII,
- Television Images, Simulated, The Subjective Sharpness of, Millard W. Baldwin, Jr., Vol. XIX, page 563.
- Television Transmission, Coaxial Cable System for, M. E. Strieby, Vol. XVII, page 438. Television Transmission over Wire Lines, M. E. Strieby and J. F. Wentz, Vol. XX, page 62. Templin, E. W., C. J. Spain and D. P. Loye, Reduction of Airplane Noise and Vibration (a Digest), Vol. XV, page 626.
- Terrain Clearance Indicator, A, Lloyd Espenschied and R. C. Newhouse, Vol. XVIII, page
- Textiles, Moisture in, Albert C. Walker, Vol. XVI, page 228. Thermionic Electron Emission, J. A. Becker, Vol. XIV, page 413.
- Thomas, U. B., H. E. Haring, E. E. Schumacher and G. S. Phipps, Superiorities of Lead-Calcium Alloys for Storage Battery Construction (a Digest), Vol. XIV, page 699.

  Thomson, H. M. and Austin Bailey, Transatlantic Long-Wave Transmission, Vol. XIV, page 680.
- Three-Phase Power Systems, A Solution for Faults at Two Locations in, E. F. Vaage,
- Vol. XIX, page 290.
  Thuras, A. L., R. T. Jenkins and H. T. O'Neil, Extraneous Frequencies Generated in Air Carrying Intense Sound Waves, Vol. XIV, page 159.
- Thuras, A. L. and E. C. Wente, Loud Speakers and Microphones, Vol. XIII, page 259.
- Time Factor in Telephone Transmission, The, O. B. Blackwell, Vol. XI, page 53. Time Intervals in Telephonic Conversation, Characteristic, A. C. Norwine and O. J.
- Murphy, Vol. XVII, page 281 Tolerances, Engineering Problems in Dimensions and, W. W. Werring, Vol. XX, page 179.
- Toll Cable, The Toronto-Barrie, M. J. Aykroyd and D. G. Geiger, Vol. XVIII, page 588.
  Toll Cables, Experience in Applying Carrier Telephone Systems to, W. B. Bedell, G. B. Ransom and W. A. Stevens, Vol. XVIII, page 547.
- Toll Transmission, L. G. Abraham, Vol. XII, page 517.
- Toll Transmission in the United States, Recent Trends in, Edwin H. Colpitts, Vol. XVI, page 119.
- Townsend, J. R. and W. J. Clarke, Plastic Materials in Telephone Use, Vol. XVIII, page 482.
- Transatlantic Telephony, A Single-Sideband Short-Wave System for, F. A. Polkinghorn and N. F. Schlaack, Vol. XIV, page 489.
   Transatlantic Long-Wave Transmission, Austin Bailey and H. M. Thomson, Vol. XIV,
- page 680.

Transcontinental Telephone Lines, J. J. Pilliod, Vol. XVIII, page 235.

Transformer Coupling Circuits for High-Frequency Amplifiers, A. J. Christopher, Vol. XI, page 608

Transformers at Audio Frequencies, Magnetic Shielding of, W. G. Gustafson, Vol. XVII. page 416.

Transformers, Communication, Improvements in, A. G. Ganz and A. G. Laird, Vol. XV, page 136.

Transmission, Toll, L. G. Abraham, Vol. XII, page 517.

anck.

ution

ssing

cine.

horn

III.

11

D.

11,

11.

r.,

38 on

ge

Transmission, Toll, in the United States, Recent Trends in, Edwin H. Colpitts, Vol. XVI, page 119.

Transmission, Transatlantic Long-Wave, Austin Bailey and H. M. Thomson, Vol. XIV, page 680. Transmission Data, Effective, for Rating Telephone Circuits, A System of, F. W. McKown

and J. W. Emling, Vol. XII, page 331.

Transmission Features of the New Telephone Sets, A. H. Inglis, Vol. XVII, page 358. Transmission Line, The Exponential, Chas. R. Burrows, Vol. XVII, page 555.

Transmission Lines, H. A. Affel, R. W. Chesnut and R. H. Mills, Vol. XIII, page 285. Transmission Lines for Short-Wave Radio Systems, E. J. Sterba and C. B. Feldman, Vol. XI, page 411.

Transmission Measuring System for Telephone Circuit Testing, A Recording, F. H. Best, Vol. XII, page 22.

Transmission Measuring Systems for Telephone Circuit Maintenance, New, F. H. Best, Vol. XVII, page 1.

Transmission Phenomena, Ultra-Short-Wave, Further Results of a Study of, C. R. Englund, A. B. Crawford and W. W. Mumford, Vol. XIV, page 369.

Transmitter and Receiver, Telephone, Scientific Research Applied to the, Edwin H.

Colpitts, Vol. XVI, page 251.

Transoceanic Radio Telephone Development (a Digest), Ralph Bown, Vol. XVI, page 560. Tubes, Ultra-High-Frequency Vacuum, Operation of, F. B. Llewellyn, Vol. XIV, page 632. Tucker, R. S., M. A. Weaver and P. S. Darnell, Crosstalk and Noise Features of Cable Carrier Telephone System, Vol. XVII, page 137.

Ultra-High Frequencies, Equivalent Networks of Negative Grid Vacuum Tubes at, F. B. Llewellyn, Vol. XV, page 575.

Ultra-High-Frequency Oscillations by Means of Diodes, The Production of, F. B. Llewellyn and A. E. Bowen, Vol. XVIII, page 280.

Ultra-High-Frequency Vacuum Tubes, Operation of, F. B. Llewellyn, Vol. XIV, page 632. Ultra-Short-Wave Propagation: Mobile Urban Transmission Characteristics, C. R. Burrows, L. E. Hunt and A. Decino, Vol. XIV, page 253.

Ultra-Short-Wave Radio Telephone System, An Unattended (a Digest), N. F. Schlaack

and F. A. Polkinghorn, Vol. XIV, page 534. Ultra-Short-Wave Transmission Phenomena, Further Results of a Study of, C. R. Englund, A. B. Crawford and W. W. Mumford, Vol. XIV, page 369.

Underground Telephone Wire, A New Type of, D. A. Quarles, Vol. XV, page 446.

Vaage, E. F., A Solution for Faults at Two Locations in Three-Phase Power Systems, Vol. XIX, page 290.

Vacuum Tube Circuits, Three-Electrode, An Extension of the Theory of, S. A. Levin and Liss C. Peterson, Vol. XIII, page 523.

Vacuum Tube Electronics at Ultra-High Frequencies, F. B. Llewellyn, Vol. XIII, page 59. Vacuum Tubes as Class B and Class C Amplifiers, The Operation of, C. E. Fay, Vol. XI, page 28.

Vacuum Tubes as High-Frequency Oscillators, M. J. Kelly and A. L. Samuel, Vol. XIV, page 97.

Vacuum Tubes, Fluctuation Noise in, G. L. Pearson, Vol. XIII, page 634.

Vacuum Tubes, The Measurement and Reduction of Microphonic Noise in, D. B. Penick, Vol. XIII, page 614.

Vacuum Tubes, Multi-Electrode, Theory of, H. A. Pidgeon, Vol. XIV, page 44.

Vacuum Tubes, Negative Grid, at Ultra-High Frequencies, Equivalent Networks of, F. R. Llewellyn, Vol. XV, page 575.

Vacuum Tubes, Ultra-High-Frequency, Operation of, F. B. Llewellyn, Vol. XIV, page 632.

Vibration.

Voice and

Volume I

Wade, L.

Walker, A

Walker, L. Ware, L. X

Watermo

Wave F

Wave ( Wave C Wave

Wave,

Wave S

Wave,

Wave,

Waves

Weave

Wente

Wente

Went

Werri

White

Wide

Wide

Wide

Wide Wide

Wid

Wid

Wie

Will

Moi

P Watson,

Te Vodas, Th

Vo

R.

- Vacuum Tubes: A New High-Efficiency Power Amplifier for Modulated Waves (a Digest). W. H. Doherty, Vol. XV, page 469.
- Vacuum Tubes: A Power Amplifier for Ultra-High Frequencies, A. L. Samuel and N. E. Sowers, Vol. XVI, page 10.
- Vacuum Tubes: Relations between Attenuation and Phase in Feedback Amplifier Design. H. W. Bode, Vol. XIX, page 421.
- Vacuum Tubes: Stabilized Feedback Amplifiers, H. S. Black, Vol. XIII, page 1. Vacuum Tubes: Transformer Coupling Circuits for High-Frequency Amplifiers, A. J. Christopher, Vol. XI, page 608.
- Vacuum Tubes: Load Rating Theory for Multi-Channel Amplifiers, B. D. Holbrook and J. T. Dixon, Vol. XVIII, page 624.
- Vacuum Tubes: Cross-Modulation Requirements on Multichannel Amplifiers below Over-load, W. R. Bennett, Vol. XIX, page 587.
- Vacuum Tubes: Contemporary Advances in Physics, XXXI—Spinning Atoms and Spinning Electrons, Karl K. Darrow, Vol. XVI, page 319.
- Vacuum Tubes: Cathode Sputtering-A Commercial Application, Hal F. Fruth, Vol. XI.
- Vacuum Tubes: Certain Factors Limiting the Volume Efficiency of Repeatered Telephone Circuits, Leonard Gladstone Abraham, Vol. XII, page 517.
- Vacuum Tubes: Further Extensions of Theory of Multi-Electrode Vacuum Tube Circuits,
- Vacuum Tubes: Further Extensions of Theory of Multi-Electrode Vacuum Tube Circuits,
   S. A. Levin and L. C. Peterson, Vol. XIV, page 666.
   Vacuum Tubes: Effect of Space Charge and Transit Time on the Shot Noise in Diodes,
   A. J. Rack, Vol. XVII, page 592.
   Vacuum Tubes: The Production of Ultra-High-Frequency Oscillations by Means of Diodes,
   F. B. Llewellyn and A. E. Bowen, Vol. XVIII, page 280.
   Vacuum Tubes: Thermionic Electron Emission,
   J. A. Becker, Vol. XIV, page 413.
- Vacuum Tubes: The Conception and Demonstration of Electron Waves, C. J. Davisson, Vol. XI, page 546.
- Vacuum Tubes: The Discovery of Electron Waves, C. J. Davisson, Vol. XVII, page 475. Vacuum Tubes: A Terrain Clearance Indicator, Lloyd Espenschied and R. C. Newhouse,
- Vol. XVIII, page 222 Vacuum Tubes: Frequency-Modulation: Theory of the Feedback Receiving Circuit, John
- R. Carson, Vol. XVIII, page 395.

  Vacuum Tubes: The Application of Negative Feedback to Frequency-Modulation Systems, J. G. Chaffee, Vol. XVIII, page 404.
- Vacuum Tubes: Copper Oxide Modulators in Carrier Telephone Systems, R. S. Caruthers, Vol. XVIII, page 315.
- Vacuum Tubes: Contemporary Advances in Physics, XXVI—The Nucleus, First Part, Karl K. Darrow, Vol. XII, page 288.
- Vacuum Tubes: Contemporary Advances in Physics, XXVII—The Nucleus, Second Part. Karl K. Darrow, Vol. XIII, page 102.
- Vacuum Tubes: Contemporary Advances in Physics, XXVIII—The Nucleus, Third Part,
- Karl K. Darrow, Vol. XIII, pages 391 and 580.

  Vacuum Tubes: Contemporary Advances in Physics, XXIX—The Nucleus, Fourth Part, Karl K. Darrow, Vol. XIV, page 285.
- Vacuum Tubes: A Negative Grid Triode Oscillator and Amplifier for Ultra-High Fre-
- quencies (a Digest), A. L. Samuel, Vol. XVI, page 568.

  Vacuum Tubes: Constant Frequency Oscillators, F. B. Llewellyn, Vol. XI, page 67.

  Vacuum Tubes: Stabilized Feedback Oscillators, G. H. Stevenson, Vol. XVII, page 458.
- Vacuum Tubes: High Accuracy Heterodyne Oscillators, T. Slonczewski, Vol. XIX, page
- Vacuum Tubes: The Cathode Ray Oscillograph, J. B. Johnson, Vol. XI, page 1. Vacuum Tubes: An Oscillograph for Ten Thousand Cycles, A. M. Curtis, Vol. XII, page 76. Vacuum Tubes: The Caesium-Oxygen-Silver Photoelectric Cell, C. H. Prescott, Jr. and
- M. J. Kelly, Vol. XI, page 334. Vacuum Tubes: Regeneration Theory, H. Nyquist, Vol. XI, page 126.
- Vacuum Tubes: Regeneration Theory and Experiment, E. Peterson, J. G. Kreer and L. A. Ware, Vol. XIII, page 680.

Vibration, Reduction of Airplane Noise and (a Digest), C. J. Spain, D. P. Loye and E. W. Templin, Vol. XV, page 626. Vodas, The, S. B. Wright, Vol. XVI, page 456.

Voice and Ear for Telephone Measurements, A. H. Inglis, C. H. G. Gray and R. T. Jenkins, Vol. XI, page 293.

Volume Indicator, A New Standard, and Reference Level, H. A. Chinn, D. K. Gannett and R. M. Morris Vol. XIX, page 94.

Wade, L. G., Electrical Drving of Telephone Cable, Vol. XIX, page 209.

Walker, A. C., Effect of Atmospheric Humidity and Temperature on the Relation between Moisture Content and Electrical Conductivity of Cotton, Vol. XII, page 431.

Moisture in Textiles, Vol. XVI, page 228.

Walker, H. G. and L. S. Ford, Pulp Insulation for Telephone Cables, Vol. XII, page 1. Ware, L. A., E. Peterson and J. G. Kreer, Regeneration Theory and Experiment, Vol. XIII, page 680. Waterman, R. E., John Leutritz and Caleb M. Hill, A Laboratory Evaluation of Wood

Preservatives, Vol. XVI, page 194.

Watson, E. F., Fundamentals of Teletypewriters Used in the Bell System, Vol. XVII, page 620.

F. B.

632 est.

ign,

and

ver-

in-

XI

me

its,

es,

of

n,

5

€.

17

5.

r,

2

Wave Function of a Radiating Dipole at the Earth's Surface, Series for the, S. O. Rice, Vol. XVI, page 101. Wave Guides, Hyper-Frequency-General Considerations and Experimental Results,

G. C. Southworth, Vol. XV, page 284.

Wave Guides, Hyper-Frequency-Mathematical Theory, John R. Carson, Sallie P. Mead and S. A. Schelkunoff, Vol. XV, page 310.

Wave Propagation, Ultra-Short: Mobile Urban Transmission Characteristics, C. R. Burrows, L. E. Hunt and A. Decino, Vol. XIV, page 253. Wave, Long-, Transmission, Transatlantic, Austin Bailey and H. M. Thomson, Vol. XIV.

page 680.

Wave System, A Single-Sideband Short-, for Transatlantic Telephony, F. A. Polkinghorn and N. F. Schlaack, Vol. XIV, page 489. Wave, Ultra-Short-, Radio Telephone System, An Unattended (a Digest), N. F. Schlaack

and F. A. Polkinghorn, Vol. XIV, page 534.

Wave, Ultra-Short-, Transmission Phenomena, Further Results of a Study of, C. R. Englund, A. B. Crawford and W. W. Mumford, Vol. XIV, page 369.

Waves, Intense Sound, Extraneous Frequencies Generated in Air Carrying, A. L. Thuras,

R. T. Jenkins and H. T. O'Neil, Vol. XIV, page 159.
Weaver, M. A., R. S. Tucker and P. S. Darnell, Crosstalk and Noise Features of Cable Carrier Telephone System, Vol. XVII, page 137.
Wente, E. C., Acoustical Instruments, Vol. XIV, page 388.

Wente, E. C. and A. L. Thuras, Loud Speakers and Microphones, Vol. XIII, page 259. Wentz, J. F. and M. E. Strieby, Television Transmission over Wire Lines, Vol. XX, page 62. Werring, W. W., Engineering Problems in Dimensions and Tolerances, Vol. XX, page 179. Whitman, A. L., L. M. Ilgenfritz and R. N. Hunter, Line Problems in the Development of the Twelve-Channel Open-Wire Carrier System, Vol. XVIII, page 363.

Wide Band: Stabilized Feedback Amplifiers, H. S. Black, Vol. XIII, page 1.

Wide Band: The Electromagnetic Theory of Coaxial Transmission Lines and Cylindrical Shields, S. A. Schelkunoff, Vol. XIII, page 532.
 Wide Band: Symposium on Wire Transmission of Symphonic Music and Its Reproduction

in Auditory Perspective, Vol. XIII, pages 239-301.

Wide-Band Open-Wire Program System, H. S. Hamilton, Vol. XIII, page 351.

Wide-Band Transformers for High Radio Frequencies, The Use of Coaxial and Balanced Transmission Lines in Filters and, W. P. Mason and R. A. Sykes, Vol. XVI, page

Wide-Band Transmission over Balanced Circuits, A. B. Clark, Vol. XIV, page 1.

Wide-Band Transmission over Coaxial Lines, Systems for, L. Espenschied and M. E. Strieby, Vol. XIII, page 654.

Wiebusch, C. F., Dial Clutch of the Spring Type, Vol. XVIII, page 724.

Willard, G. W., I. E. Fair and F. R. Lack, Some Improvements in Quartz Crystal Circuit Elements, Vol. XIII, page 453.

- Willets, H. N., Ship Sets for Harbor Ship-to-Shore Service (a Digest), Vol. XIV, page 713 Wilkinson, Roger I., The Reliability of Holding Time Measurements, Vol. XX, page 365 Williams, H. B., L. P. Ferris, B. G. King and P. W. Spence, Effect of Electric Shock on the Heart (a Digest), Vol. XV, page 455.
- Wiltrakis, J. E., Part II of Design and Operation of New Copper Wire Drawing Plant, Vol. XX, page 111.
- Winds, Oblique, on Telephone Wires, Forces of, J. A. Carr, Vol. XV, page 587. Wire, Underground Telephone, A New Type of, D. A. Quarles, Vol. XV, page 446.
- Wire Communication Aids to Air Transportation, H. H. Nance, Vol. XI, page 462. Wire Drawing Plant, New Copper, Design and Operation of: Part I-Design and Opera-
- tion of High Speed Copper Wire Drawing Machines, H. Blount, Vol. XX, page 95. Part II—Equipping and Operating the New Wire Mill, J. E. Wiltrakis, Vol. XX. page 111.
- Wire Spacing Problems, Telephone Line, Studies of, J. A. Carr and F. V. Haskell, Vol. XVII, page 195.

  Wires, Steel Telephone, A Magneto-Elastic Source of Noise in, W. O. Pennell and H. P. Lawther, Vol. XV, page 334.
- Wise, W. Howard, The Physical Reality of Zenneck's Surface Wave, Vol. XVI, page 35 Wood, E. B. and D. R. Brobst, Cellulose Acetate Treatment for Textile Insulation-Engineering Development, Vol. XI, page 213.
- Wood Preservatives, A Laboratory Evaluation of, R. E. Waterman, John Leutritz and Caleb M. Hill, Vol. XVI, page 194.
- World's Fair Hearing Tests, Results of the, J. C. Steinberg, H. C. Montgomery and M. B. Gardner, Vol. XIX, page 533.
- World-Wide Telephony-Its Problems and Future, Bancroft Gherardi and Frank B. Jewett, Vol. XI, page 485.
- Wrathall, L. R. and L. W. Hussey, Oscillations in an Electromechanical System, Vol. XV. page 441.
- Wratháll, L. R., E. Peterson and J. M. Manley, Magnetic Generation of a Group of Harmonics, Vol. XVI, page 437.
- Wright, S. B., Amplitude Range Control, Vol. XVII, page 520.
- The Vodas, Vol. XVI, page 456. Wright, S. B. and R. C. Mathes, The Compandor—An Aid Against Static in Radio Telephony, Vol. XIII, page 315.
- Wright, S. B. and D. Mitchell, Two-Way Radio Telephone Circuits, Vol. XI, page 368.

Zenneck's Surface Wave, The Physical Reality of, W. Howard Wise, Vol. XVI, page 35.

13, 65, on fol. ra-25, X, ol. P. gi-nd B. W. ur 5.